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(54) DISPLAY DEVICE

TECHNICAL FIELD

[The technical field to which invention belongs] The invention in this application relates to the ElectroLuminescent Display (display) which made EL (electroluminescence) element on the substrate and was formed. It is related with the ElectroLuminescent Display especially using the semiconductor device (element using the semiconductor thin film). Moreover, it is related with the electronic equipment which used the ElectroLuminescent Display for the display.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
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ElectroLuminescent Display especially using the semiconductor device (element using the semiconductor thin film). Moreover, it is related with the electronic equipment which used the ElectroLuminescent Display for the display.

[0002]

[Description of the Prior Art] In recent years, on the substrate, the technology which forms TFT progresses sharply and application development to active-matrix type display is furthered. Since electric field effect mobility (it is also called mobility) is higher than TFT using the conventional amorphous silicon film, high-speed operation is possible for especially TFT using the polysilicon contest film. Therefore, it is possible to perform control of a pixel in the drive circuit besides a substrate conventionally in the drive circuit formed on the same substrate as a pixel.

[0003] Various advantages, such as reduction of a manufacturing cost, a miniaturization of display, elevation of the yield, and reduction of a throughput, are acquired because such active-matrix type display makes various circuits and elements on the same substrate.

[0004] And research of an active-matrix type ElectroLuminescent Display with the EL element is activating as a spontaneous light type element further. The ElectroLuminescent Display is also called the organic EL display (OELD:Organic EL Display) or organic light emitting diode (OLED:Organic Light Emitting Diode).

[0005] Unlike a liquid crystal display, an ElectroLuminescent Display is a spontaneous light type. Although the EL element has the structure where EL layer was pinched by inter-electrode [of a couple], EL layer usually has a laminated structure. Typically, the laminated structure "the electron hole transporting bed / luminous layer / electronic transporting bed" which Tang and others of Eastman Kodak Co. proposed is mentioned. This structure has very high luminous efficiency, and most ElectroLuminescent Displays to which research and development are advanced have adopted this structure now.

[0006] Moreover, otherwise, the structure which carries out a laminating to the order of a hole-injection layer / electron hole transporting bed / luminous layer / electronic transporting bed, or a hole-injection layer / electron hole transporting bed / luminous layer / electronic transporting bed / electron-injection layer on a pixel electrode is sufficient. You may dope fluorescence nature coloring matter etc. to a luminous layer.

[0007] All the layers prepared in inter-electrode [of a couple] in this specification are named generically, and it is called EL layer. Therefore, all of the hole-injection layer mentioned above, an electron hole transporting bed, a luminous layer, an electronic transporting bed, an electron-injection layer, etc. are contained in EL layer.

[0008] And predetermined voltage is applied to EL layer which becomes with the above-mentioned structure from the electrode of a couple, and thereby, in a luminous layer, the reunion of a carrier happens and light is emitted. In addition, if an EL element drives that an EL element emits light in this specification, it will be called. Moreover, in this specification, the light emitting device formed by the anode plate, EL layer, and cathode is called EL element.

[0009]

[Problem(s) to be Solved by the Invention]

[0010] When putting an ElectroLuminescent Display in practical use, the shortness of the life of the EL element by degradation of EL layer had become a problem. As a factor which influences the length of the life of EL layer, the conditions in the structure of the device which drives an ElectroLuminescent Display, the property of organic EL material which constitutes EL layer, the material of an electrode, and creation distance etc. are mentioned.

[0011] And the drive method of an ElectroLuminescent Display is observed recently as a factor which influences the length of the life of EL layer other than the factor mentioned above.

[0012] In order to make an EL element emit light, generally the method of applying the current of a direct current to two electrodes whose EL layers were pinched, an anode plate and cathode, has been used conventionally. The time-sharing gradation display of the conventional digital method is explained using drawing 16 . Here, the case where a n bit digital drive method performs the full color display of 2n gradation is explained.

[0013] The structure of the pixel section of an ElectroLuminescent Display is shown in drawing 15 . The gate signal line (G1-Gn) into which a gate signal is inputted is connected to the gate electrode of TFT1501 for switching which each pixel has. Moreover, as for the source field and drain field of TFT1501 for switching which each pixel has, one side is connected to the capacitor 1508 which the gate electrode and each pixel of TFT1504 for EL drive which each pixel has [another side] have in the digital data signal at the source signal line (it is also called a data signal line) (S1-Sn) to input, respectively.

[0014] the source field and drain field of TFT1504 for EL drive which each pixel has -- respectively -- on the other hand, another side is connected to the current supply line (V1-Vn) at EL element 1506 The potential of a current supply line (V1-Vn) is called power supply potential. Moreover, the current supply line (V1-Vn) is connected to the capacitor 1508 which each pixel has. In addition, a digital data signal means a digital video signal.

[0015] EL element 1506 consists of an EL layer prepared between an anode plate, cathode, and an anode plate and cathode. When the anode plate has connected with the source field of TFT1504 for EL drive, or a drain field, it puts in another way and an anode plate is a pixel electrode, the cathode which is a counterelectrode is maintained at fixed potential. Conversely, when cathode has connected with the source field of TFT1504 for EL drive, or a drain field, it puts in another way and cathode is a pixel electrode, the anode plate which is a counterelectrode is maintained at fixed potential.
[0016] Moreover, in this specification, the potential of a counterelectrode is called stationary potential. In addition, the power supply which gives a stationary potential to a counterelectrode is called regular power supply. As for the potential of an anode plate, it is desirable that it is higher than the potential concerning cathode. Therefore, a stationary potential changes a counterelectrode by the anode plate or cathode. For example, when a counterelectrode is an anode plate, as for a stationary potential, it is desirable to make it higher than power supply potential. Conversely, when a counterelectrode is cathode, as for a stationary potential, it is desirable to make it lower than power supply potential.
[0017] The potential difference of the stationary potential of a counterelectrode and the power supply potential of a pixel electrode is EL driver voltage, and this EL driver voltage is built over EL layer.
[0018] The timing chart in the direct-current drive of the digital method of the conventional ElectroLuminescent Display is shown in drawing 16 . First, an one-frame period is divided during [n] the subframe (SF1-SFn). In addition, all the pixels of the pixel section call the period which displays one picture one-frame period (F). In the usual ElectroLuminescent Display, 60 or more frame periods are prepared in 60Hz or more, i.e., 1 second, and, as for oscillation frequency, 60 or more pictures are displayed in 1 second. When the number of the pictures displayed in 1 second becomes less than 60, a flicker of pictures, such as a flicker, begins to be visually conspicuous. In addition, the period which divided the one-frame period into plurality further is called subframe period. The number of partitions of an one-frame period must also increase as the number of gradation increases, and you have to drive a drive circuit on high frequency.
[0019] One subframe period is divided into an address period (Ta) and a sustain period (Ts). An address period is time taken to input data into all pixels during the 1 subframe, and the sustain period (it is also called a lighting period) shows the period which makes an EL element emit light.
[0020] All the length of the address period (Ta1-Tan) which it has, respectively has n

the same subframe periods (SF1-SFn). SF1-SFn set to Ts1-Tsn the sustain period (Ts) which it has, respectively, respectively.

[0021] The length of a sustain period is [-- It sets up so that it may become :2-(n-2):2- (n-1).] Ts1:Ts2:Ts3. : -- It is :Ts(n-1):Tsn=20:2-1:2-2. : However, you may carry out sequence of making SF1-SFn appearing, what. A desired gradation display can be performed among 2n gradation in the combination of this sustain period.

[0022] In the address period, the current supply line (V1-Vn) is first maintained at the power supply potential of the same height as a stationary potential. In this specification, it is called the power supply potential of OFF of the power supply potential in the address period of a digital drive. In addition, the height of the power supply potential of OFF is the range in which EL element 1506 does not emit light, and if it is the same as the height of a stationary potential, it is good. In addition, it is called EL driver voltage of OFF of EL driver voltage at this time. Although it is ideally desirable that it is 0V as for EL driver voltage of OFF, what is necessary is just the size which is the grade to which EL element 1506 does not emit light.

[0023] And a gate signal is inputted into the gate signal line G1, and TFT1501 for switching by which the gate electrode is connected to the gate signal line G1 will be in the state of ON altogether.

[0024] And in the state of ON of TFT1501 for switching by which the gate electrode is connected to the gate signal line G1, a digital data signal is inputted into a source signal line (S1-Sn) in order. The digital data signal has the information on "0" or "1", and means the signal with which the digital data signal of "0" and "1" has the voltage of either Hi or Lo, respectively. And the digital data signal inputted into the source signal line (S1-Sn) is inputted into the gate electrode of TFT1504 for EL drive through TFT1501 for switching of the state of ON (ON). Moreover, a digital data signal is inputted also into a capacitor 1508, and it is held.

[0025] next, TFT1501 for switching by which a gate signal is inputted into the gate signal line G2, and the gate electrode is connected to the gate signal line G2 -- all will be in the state of ON And where TFT1501 for switching by which the gate electrode is connected to the gate signal line G2 is turned ON, a digital data signal is inputted into a source signal line (S1-Sn) in order. The digital data signal inputted into the source signal line (S1-Sn) is inputted into the gate electrode of TFT1504 for EL drive through TFT1501 for switching. Moreover, a digital data signal is inputted also into a capacitor 1508, and it is held.

[0026] Operation mentioned above is repeated and a digital data signal is inputted into all pixels. A period until a digital data signal is inputted into all pixels is an address

period.

[0027] An address period turns into a sustain period simultaneously with an end. If a sustain period comes, the potential of a current supply line (V1-Vn) will change to the power supply potential of ON from the power supply potential of OFF. In a digital drive, in this specification, it is called the power supply potential of ON of the power supply potential in a sustain period. The power supply potential of ON should just have the potential difference between stationary potentials in the grade to which an EL element emits light. In addition, it is called EL driver voltage of ON of this potential difference. In addition, the power supply potential of OFF and the power supply potential of ON are named generically, and it is called power supply potential. Moreover, EL driver voltage of ON and EL driver voltage of OFF are named generically, and it is called EL driver voltage.

[0028] In a sustain period, TFT1501 for switching will be in an OFF state. And the digital data signal held in the capacitor 1508 is inputted into the gate electrode of TFT1504 for EL drive.

[0029] When the digital data signal has the information on "0", TFT1504 for EL drive will be in an OFF state, and the pixel electrode of EL element 1506 is maintained at the power supply potential of OFF. Consequently, EL element 1506 which the pixel to which the digital data signal which has the information on "0" was impressed has does not emit light.

[0030] On the contrary, when it has the information on "1", TFT1504 for EL drive will be in an ON state, and the pixel electrode of EL element 1506 becomes the power supply potential of ON. Consequently, EL element 1506 which the pixel to which the digital data signal which has the information on "1" was impressed has emits light.

[0031] The period all whose TFT1501 for switching is OFF states is a sustain period.

[0032] An EL element emits light in one to Ts1-Tsn of periods. In the period of Tsn, it carries out to having made the predetermined EL element emit light (a predetermined pixel being turned on).

[0033] Next, a sustain period appears, after an address period's appearing again and inputting a digital data signal into all pixels. At this time, the sustain period of either Ts1-Ts (n-1) appears. Here, Ts (n-1) appears and it carries out to having made the predetermined pixel turn on in the period of Ts (n-1).

[0034] Hereafter, the same operation is repeated also in the n-2 remaining subframes, and they are Ts (n-2) and Ts (n-3) one by one. -- Ts1 and a sustain period appear and it carries out to having made the predetermined pixel turn on in each subframe.

[0035] When n subframe periods appear, it means finishing an one-frame period. At

this time, the gradation of the pixel is decided by integrating the length of the sustain period immediately after the sustain period which the pixel had turned on within the one-frame period, and the address period when the digital data signal which in other words has the information on "1" was impressed to the pixel. For example, when brightness when a pixel emits light in all sustain periods was made into 100% at the time of n= 8 and a pixel emits light in Ts1 and Ts2, 75% of brightness can be expressed, and when Ts3, and Ts5 and Ts8 are chosen, 16% of brightness can be expressed.

[0036] Thus, the direct-current drive of the ElectroLuminescent Display is carried out conventionally, and EL driver voltage applied to EL layer had the always same polarity.

[0037] However, it is found out by applying reverse polar EL driver voltage to an EL element for every fixed period that degradation of the current-voltage characteristic of an EL element is improved as introduced in "TSUTSUI T, JPN J Appl Phys Part 2 VOL.37, and NO.11B PAGE.L1406-L1408 1998."

[0038] However, the ElectroLuminescent Display using the drive method of the ElectroLuminescent Display using degradation of the current-voltage characteristic of an EL element being improved and the aforementioned drive method was not specifically proposed by applying reverse polar EL driver voltage to an EL element for every fixed period.

[0039] Then, in order to prolong the life of an EL element, it was anxious for production of the ElectroLuminescent Display using the proposal of the drive method (in this specification, it is hereafter called an alternating current drive) and the aforementioned drive method of the ElectroLuminescent Display which displays on an EL element by applying reverse polar EL driver voltage for every fixed period. It was anxious for production of the active-matrix type ElectroLuminescent Display which displays especially by alternating current drive.

[0040]

[Means for Solving the Problem] In the drive of an ElectroLuminescent Display, the invention in this application maintains at fixed potential (regular potential) the 1st electrode which an EL element has, and maintains the 2nd electrode at the potential (power supply potential) of a current supply line. And for every fixed period, regular potential is fixed and the height of power supply potential is changed so that the polarity of EL driver voltage which is the difference of regular potential and power supply potential may become reverse. For example, supposing VT and power supply potential are [VD and EL driver voltage] VT-VD=deltaV in a certain period for regular potential, VD' and EL driver voltage will be set [regular potential] to VT-VD'=-deltaV by VT and power supply potential in the next period.

[0041] In the time-sharing gradation display by the drive circuit of a digital method, the polarity of EL driver voltage may be conversely changed for every one-frame period, and the polarity of EL driver voltage may be conversely changed for every 1 subframe period.

[0042] In the case of the drive circuit of an analog method, EL driver voltage is changed to reverse polarity for every one-frame period.

[0043] In addition, since an EL element is diode, when EL driver voltage with a certain polarity is applied and an EL element emits light, EL driver voltage, in addition the ** EL element which have reverse polarity do not emit light.

[0044] By the above-mentioned composition, reverse polar EL driver voltage is built over an EL element for every fixed period. Therefore, degradation of the current-voltage characteristic of an EL element is improved and it becomes possible to lengthen the life of an EL element compared with the conventional drive method.

[0045] Moreover, in an alternating current drive, as mentioned above, when displaying a picture for every one-frame period, a flicker will arise as a flicker to an observer's eyes.

[0046] Therefore, in the invention in this application, it is desirable to carry out the alternating current drive of the ElectroLuminescent Display on the frequency of the double not less of the frequency which a flicker does not produce to an observer's eyes in a direct-current drive. That is, it is desirable to prepare 120 or more frame periods and to display 60 or more pictures in 1 second. The above-mentioned composition protects the flicker by alternating current drive.

[0047] Moreover, the alternating current drive of the invention in this application is applicable not only to active-matrix type EL display but passive type EL display.

[0048] Below, the composition of the invention in this application is shown.

[0049] It is the display which has two or more pixels containing two or more EL elements by the invention in this application. A gradation display is performed because the aforementioned display controls time for two or more aforementioned EL elements in an one-frame period to emit light. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the potential of the 2nd electrode of the above The display characterized by changing so that the polarity of EL driver voltage which is the difference of the potential concerning the 1st electrode of the above and the potential concerning the 2nd electrode of the above may become reverse for every one-frame period is offered.

[0050] It is the display which has two or more pixels containing two or more EL

elements by the invention in this application. the aforementioned display A gradation display is performed by controlling the sum of the length of the subframe period when two or more aforementioned EL elements emitted light among two or more subframe periods contained in an one-frame period. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the potential of the 2nd electrode of the above The display characterized by changing so that the polarity of EL driver voltage which is the difference of the potential concerning the 1st electrode of the above and the potential concerning the 2nd electrode of the above may become reverse for every aforementioned subframe period is offered.

[0051] Two or more TFT for EL drive which controls luminescence of two or more EL elements and two or more aforementioned EL elements by the invention in this application, respectively, Two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively, Are the display which has the pixel of ****** plurality and a gradation display is performed because the aforementioned display controls time for two or more aforementioned EL elements in an one-frame period to emit light. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the potential of the 2nd electrode of the above The display characterized by changing so that the polarity of EL driver voltage which is the difference of the potential concerning the 1st electrode of the above and the potential concerning the 2nd electrode of the above may become reverse for every one-frame period is offered.

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aforementioned frame period is offered.

[0053] It is the display which has two or more pixels containing two or more EL elements by the invention in this application. A gradation display is performed because the aforementioned display controls time for two or more aforementioned EL elements in an one-frame period to emit light. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the potential of the 2nd electrode of the above By the pixels which are changing so that the polarity of EL driver voltage which is the difference of the potential concerning the 1st electrode of the above and the potential concerning the 2nd electrode of the above may become reverse for every one-frame period, and adjoin each other among two or more aforementioned pixels The display characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above is offered.

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[0055] Two or more TFT for EL drive which controls luminescence of two or more EL elements and two or more aforementioned EL elements by the invention in this application, respectively, Two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively, Are the display which has the pixel of ****** plurality and a gradation display is performed because the aforementioned display controls time for two or more aforementioned EL elements in an one-frame period to emit light. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the potential of the 2nd electrode of the above By the pixels which are changing so that the polarity of EL driver voltage which is the

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[0056] Two or more TFT for EL drive which controls luminescence of two or more EL elements and two or more aforementioned EL elements by the invention in this application, respectively, It is the display which has two or more pixels containing two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. the aforementioned display A gradation display is performed by controlling the sum of the length of the subframe period when two or more aforementioned EL elements emitted light among two or more subframe periods contained in an one-frame period. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the potential of the 2nd electrode of the above By the pixels which are changing so that the polarity of EL driver voltage which is the difference of the potential concerning the 1st electrode of the above and the potential concerning the 2nd electrode of the above may become reverse for every aforementioned subframe period, and adjoin each other among two or more aforementioned pixels The display characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above is offered.

[0057] The aforementioned TFT for EL drive and the aforementioned TFT for switching are n channel type TFT or p-channel type TFT.

[0058] Luminescence of two or more aforementioned EL elements may be controlled by the digital data signal inputted into TFT for switching.

[0059] The aforementioned one-frame period should just be 1/120 or less s.

[0060] Two or more TFT for EL drive which controls luminescence of two or more EL elements and two or more aforementioned EL elements by the invention in this application, respectively, It is the display which has two or more pixels containing two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. the aforementioned display A gradation display is performed in inputting the video signal of an analog into the source field of TFT for switching. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the 2nd electrode of the above The display characterized by being maintained at the voltage which has reverse polarity on the basis of the voltage built

over the 1st electrode for every one-frame period is offered.

[0061] Two or more TFT for EL drive which controls luminescence of two or more EL elements and two or more aforementioned EL elements by the invention in this application, respectively, It is the display which has two or more pixels containing two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. the aforementioned display A gradation display is performed in inputting the video signal of an analog into the source field of TFT for switching. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the 2nd electrode of the above It is maintained at the voltage which has reverse polarity on the basis of the voltage built over the 1st electrode for every one-frame period, and the display characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above between the pixels which adjoin each other among two or more aforementioned pixels is offered.

[0062] The aforementioned TFT for EL drive and the aforementioned TFT for switching are n channel type TFT or p-channel type TFT.

[0063] The aforementioned one-frame period should just be 1/120 or less s.

[0064] EL layer which two or more aforementioned EL elements have may be a low-molecular system organic substance or a polymer system organic substance.

[0065] The aforementioned low-molecular system organic substance may consist of Alq3 (tris-8-kino rewrite-aluminum) or TPD (triphenylamine derivative).

[0066] The aforementioned polymer system organic substance may consist of PPV (polyphenylene vinylene), PVK (polyvinyl carbazole), or a polycarbonate.

[0067] The computer characterized by using the aforementioned display.

[0068] The video camera characterized by using the aforementioned display.

[0069] The DVD player characterized by using the aforementioned display.

[0070]

[Embodiments of the Invention]

[0071] The time-sharing gradation display of a digital drive method is explained using the example of an ElectroLuminescent Display which constitutes the invention in this application. An example of the circuitry of the invention in this application is shown in drawing 1 .

[0072] The ElectroLuminescent Display of drawing 1 has the source signal side drive circuit 102 arranged by TFT formed on the substrate around the pixel section 101 and the pixel section, and the gate signal side drive circuit 103. In addition, although the ElectroLuminescent Display has a source signal side drive circuit and every one gate

signal side drive circuit with the gestalt of this operation, in the invention in this application, there may be two source signal side drive circuits. Moreover, there may also be two gate signal side drive circuits.

[0073] The source signal side drive circuit 102 contains shift register 102a, (Latch A) 102b, and (Latch B) 102c fundamentally. Moreover, a clock signal (creatine kinase) and a start pulse (SP) are inputted into shift register 102a, a digital data signal (Digital Data Signals) is inputted into (Latch A) 102b, and a latch signal (Latch Signals) is inputted into (Latch B) 102c.

[0074] Moreover, although not illustrated, the gate signal side drive circuit 103 has a shift register and a buffer. You may prepare a multiplexer in the output side of a buffer.

[0075] The digital data signal inputted into the pixel section 101 is formed in the time-sharing gradation data signal generating circuit 114. In this circuit, while changing the video signal (signal containing image information) which becomes with an analog signal or a digital signal into the digital data signal for performing time-sharing gradation, it is the circuit which generates a timing pulse required in order to perform a time-sharing gradation display etc.

[0076] Typically in the time-sharing gradation data signal generating circuit 114 A means to divide an one-frame period during [two or more] the subframe corresponding to n bits (for n to be two or more integers) gradation, A means to choose an address period and a sustain period in the subframe period of these plurality, It is [-- A means to set up so that it may become :2-(n-2):2- (n-1) is included.] Ts1:Ts2:Ts3 about the length of the sustain period. : -- :Ts(n-1):Ts(n) =20:2-1:2-2 :

0077] This time-sharing gradation data signal generating circuit 114 may be established in the exterior of the ElectroLuminescent Display of the invention in this application. In this case, it becomes the composition that the digital data signal formed there is inputted into the ElectroLuminescent Display of the invention in this application. In this case, the electronic equipment (EL display) which has the ElectroLuminescent Display of the invention in this application as a display display will include the ElectroLuminescent Display of the invention in this application, and a time-sharing gradation data signal generating circuit as another parts.

[0078] Moreover, you may mount the time-sharing gradation data signal generating circuit 114 in the ElectroLuminescent Display of the invention in this application in forms, such as IC chip. In this case, it becomes the composition that the digital data signal formed with the IC chip is inputted into the ElectroLuminescent Display of the invention in this application. In this case, the electronic equipment which has the

ElectroLuminescent Display of the invention in this application as a display will contain as parts the ElectroLuminescent Display of the invention in this application which mounted IC chip including a time-sharing gradation data signal generating circuit.

[0079] Moreover, finally, on the same substrate as the pixel section 101, the source signal side drive circuit 102, and the gate signal side drive circuit 103, it has the time-sharing gradation data signal generating circuit 114 by TFT, and it can be formed. In this case, if the video signal which contains image information in an ElectroLuminescent Display is inputted, all can be processed on a substrate. The time-sharing gradation data signal generating circuit in this case may form a polysilicon contest film by TFT made into a barrier layer. Moreover, the time-sharing gradation data signal generating circuit is built in the ElectroLuminescent Display itself, and the electronic equipment which has the ElectroLuminescent Display of the invention in this application as a display in this case can attain the miniaturization of electronic equipment.

[0080] Two or more pixels 104 are arranged by the shape of a matrix at the pixel section 101. The enlarged view of a pixel 104 is shown in drawing 2 (A). In drawing 2 (A), 105 is TFT for switching. The gate electrode of TFT105 for switching is connected to the gate signal line 106 which inputs a gate signal. The source field and drain field of TFT105 for switching are connected to the capacitor 113 which the gate electrode and each pixel of TFT108 for EL drive have [another side] in the source signal line 107 into which one side inputs a digital data signal, respectively.

[0081] Moreover, as for the source field and drain field of TFT108 for EL drive, one side is connected to the current supply line 111, and another side is connected to EL element 110. The current supply line 111 is connected to the capacitor 113. When TFT105 for switching is in the state (OFF state) where it does not choose, the capacitor 113 is formed in order to hold the gate voltage of TFT108 for EL drive.

[0082] EL element 110 consists of an EL layer prepared between an anode plate, cathode, and an anode plate and cathode. Cathode is a counterelectrode, when the anode plate has connected with the source field of TFT110 for EL drive, or a drain field, it puts in another way and an anode plate is a pixel electrode. Conversely, an anode plate is a counterelectrode, when cathode has connected with the source field of TFT110 for EL drive, or a drain field, it puts in another way and cathode is a pixel electrode.

[0083] The current supply line 111 is maintained at power supply potential. It is [0084] maintained at potential with always fixed power supply potential in the gestalt of this operation. In addition, you may prepare a resistor between the drain field of TFT108 for EL drive or a source field, and EL element 110. By preparing a resistor, the amount of

current supplied to an EL element from TFT for EL drive is controlled, and it becomes possible to prevent the influence of the variation in the property of TFT for EL drive. If a resistor is an element which shows resistance larger enough than the on resistance of TFT108 for EL drive, since it is good, there will be no limitation in structure etc. In addition, an on resistance is the value which broke the drain voltage of TFT by the drain current which is flowing then, when TFT is an ON state. What is necessary is just to choose from the range of 1kohm-50M omega (preferably 10 k ohm - 10 M omega, still more preferably 50 k ohm - 1 M omega) as resistance of a resistor. When a semiconductor layer with resistance high as a resistor is used, formation is easy and desirable.

[0085] Next, the alternating current drive of the invention in this application is explained using drawing 2 (B) and drawing 3 . Here, the case where a n bit digital drive method performs the full color time-sharing gradation display of 2n gradation is explained.

[0086] The structure of the pixel section of the ElectroLuminescent Display of the invention in this application is shown in drawing 2 (B). The gate signal line (G1-Gn) is connected to the gate electrode of TFT for switching which each pixel has. One side is connected to a source signal line (S1-Sn), and, as for the source field and drain field of TFT for switching which each pixel has, another side is connected to the gate electrode and capacitor of TFT for EL drive. Moreover, as for the source field and drain field of TFT for EL drive, one side is connected to the current supply line (V1-Vn) at the EL element which each pixel has [another side]. The capacitor by which each pixel has a current supply line (V1-Vn) is connected.

[0087] The timing chart in the ElectroLuminescent Display shown in drawing 2 (A) is shown in drawing 3 . First, an one-frame period (F) is divided during [n] the subframe (SF1-SFn). In addition, all the pixels of the pixel section call the period which displays one picture one-frame period. In the ElectroLuminescent Display of the invention in this application, 120 or more frame periods are prepared in 1 second, and it is desirable that 60 or more pictures are displayed in 1 second as a result.

[0088] When the number of the pictures displayed in 1 second becomes less than 120, a flicker of pictures, such as a flicker, begins to be visually conspicuous.

[0089] In addition, the period which divided the one-frame period into plurality further is called subframe period. The number of partitions of an one-frame period must also increase as the number of gradation increases, and you have to drive a drive circuit on high frequency.

[0090] One subframe period is divided into an address period (Ta) and a sustain period

(Ts). An address period is time taken to input data into all pixels during the 1 subframe, and the sustain period (it is also called a lighting period) shows the period which displays.

[0091] All the length of the address period (Ta1-Tan) which it has, respectively has n the same subframe periods (SF1-SFn). SF1-SFn set to Ts1-Tsn the sustain period (Ts) which it has, respectively, respectively.

[0092] The length of a sustain period is [-- It sets up so that it may become :2-(n-2):2-(n-1).] Ts1:Ts2:Ts3. : -- It is :Ts(n-1):Tsn=20:2-1:2-2. : However, you may carry out sequence of making SF1-SFn appearing, what. A desired gradation display can be performed among 2n gradation in the combination of this sustain period.

[0093] In the address period, the counterelectrode is first maintained at the stationary potential of the same height as power supply potential. In this specification, it is called the stationary potential of OFF of the stationary potential in the address period of a digital drive. In addition, the height of the stationary potential of OFF is the range in which an EL element does not emit light, and if it is the same as the height of power supply potential, it is good. In addition, it is called EL driver voltage of OFF of EL driver voltage at this time. Although it is ideally desirable that it is 0V as for EL driver voltage of OFF, what is necessary is just the size which is the grade to which an EL element does not emit light.

[0094] And a gate signal is inputted into the gate signal line G1, and all TFT for switching by which the gate electrode is connected to the gate signal line G1 will be in the state of ON.

[0095] In the state of ON of TFT for switching by which the gate electrode is connected to the gate signal line G1, a digital data signal is simultaneously inputted into all source signal lines (S1-Sn). The digital data signal has the information on "0" or "1", and means the signal with which the digital data signal of "0" and "1" has the voltage of either Hi or Lo, respectively. And the digital data signal inputted into the source signal line (S1-Sn) is inputted into the gate electrode of TFT for EL drive through TFT for switching of the state of ON (ON). Moreover, a digital data signal is inputted also into a capacitor and it is held.

[0096] Next, a gate signal is inputted into the gate signal line G2, and all TFT for switching by which the gate electrode is connected to the gate signal line G2 will be in the state of ON. And where TFT for switching by which the gate electrode is connected to the gate signal line G2 is turned ON, a digital data signal is simultaneously inputted into all source signal lines (S1-Sn). The digital data signal inputted into the source signal line (S1-Sn) is inputted into the gate electrode of TFT for EL drive through TFT

for switching. Moreover, a digital data signal is inputted also into a capacitor and it is held.

[0097] Operation mentioned above is repeated and a digital data signal is inputted into all pixels. A period until a digital data signal is inputted into all pixels is an address period.

[0098] A sustain period comes at the same time an address period expires. If a sustain period comes, the potential of a counterelectrode will change to the stationary potential of ON from the stationary potential of OFF. In this specification, it is called the stationary potential of ON of the stationary potential in the sustain period of a digital drive. The stationary potential of ON should just have the potential difference between power supply potentials in the grade to which an EL element emits light. In addition, it is called EL driver voltage of ON of this potential difference.

[0099] And TFT for switching is turned off and the digital data signal held in the capacitor is inputted into the gate electrode of TFT for EL drive.

[0100] In the gestalt of this operation, when the digital data signal has the information on "0", TFT for EL drive will be in an OFF state, and the pixel electrode of an EL element is maintained at the stationary potential of OFF. Consequently, the EL element which the pixel to which the digital data signal which has the information on "0" was impressed has does not emit light.

[0101] On the contrary, when it has the information on "1", TFT for EL drive will be in an ON state, and power supply potential is given to the pixel electrode of an EL element. Consequently, the EL element which the pixel to which the digital data signal which has the information on "1" was impressed has emits light.

[0102] The period all whose TFT for switching is OFF states is a sustain period.

[0103] The periods which make an EL element emit light (a pixel is made to turn on) are one to Ts1-Tsn of periods. Here, it carries out to having made the pixel of Tsn predetermined during the period turn on.

[0104] Next, an address period appears again, and if a data signal is inputted into all pixels, a sustain period will appear. At this time, the sustain period of either Ts1-Ts (n-1) appears. Here, it carries out to having made the pixel of Ts (n-1) predetermined during the period turn on.

[0105] The operation same about the n-2 remaining subframes is repeated hereafter, and they are Ts (n-2) and Ts (n-3) one by one. -- Ts1 and a sustain period are set up and it carries out to having made the pixel predetermined by each subframe turn on.

[0106] When n subframe periods appear, it means finishing an one-frame period. At this time, the gradation of the pixel is decided by integrating the length of the sustain period

immediately after the sustain period which the pixel had turned on within the one-frame period, and the address period when the digital data signal which in other words has the information on "1" was impressed to the pixel. For example, when brightness when a pixel emits light in all sustain periods was made into 100% at the time of n= 8 and a pixel emits light in Ts1 and Ts2, 75% of brightness can be expressed, and when Ts3, and Ts5 and Ts8 are chosen, 16% of brightness can be expressed.

[0107] An end of an one-frame period changes the height of the stationary potential of ON so that the polarity of EL driver voltage of the ON which it is with the difference of power supply potential and the stationary potential of ON may become reverse in the next frame period. and a previous frame period -- the same -- operation mentioned above is performed However, since EL driver voltage of the ON in this frame period has the reverse polarity of EL driver voltage of the ON in a previous frame period, no EL elements emit light. In this specification, the frame period when an EL element displays a picture is called display frame period. Moreover, the frame period which does not display a picture, without no EL elements emitting light conversely is called non-display frame period.

[0108] After a non-display frame period expires, display frame period another next comes and EL driver voltage of ON changes to the voltage which has the reverse polarity of EL driver voltage of the ON in a non-display frame period.

[0109] Thus, a picture is displayed by repeating a display frame period and a non-display frame period by turns. The invention in this application is having the above-mentioned composition, and requires reverse polar EL driver voltage for EL layer which an EL element has for every fixed period. Therefore, degradation of the current-voltage characteristic of an EL element is improved and it becomes possible to lengthen the life of an EL element compared with the conventional drive method.

[0110] Moreover, in an alternating current drive, as mentioned above, when displaying a picture for every one-frame period, a flicker will arise as a flicker to an observer's eyes.

[0111] Therefore, at the invention in this application, the alternating current drive of the ElectroLuminescent Display is carried out on the frequency of the double not less of the frequency which a flicker does not produce to an observer's eyes in a direct-current drive. That is, 120 or more frame periods are prepared in 1 second, and 60 or more pictures are displayed in 1 second as a result. The above-mentioned composition protects the flicker by alternating current drive.

[0112] In addition, in the drive method of an ElectroLuminescent Display shown with the gestalt of this operation, by always keeping power supply potential constant and changing opposite potential in an address period and a sustain period, the size of EL

driver voltage was changed and luminescence of an EL element was controlled. However, the invention in this application is not limited to this composition. The ElectroLuminescent Display of the invention in this application may always keep opposite potential constant, and may change the potential of a pixel electrode. That is, you may control luminescence of an EL element by always keeping the potential of a counterelectrode constant, changing power supply potential in an address period and a sustain period contrary to the case of the gestalt of operation, and changing the size of EL driver voltage.

[0113] Moreover, with the gestalt of this operation, since the potential and power supply potential of a counterelectrode were maintained at the same potential in the address period, the EL element did not emit light. However, the invention in this application is not limited to this composition. Also in an address period, you may be made to display by always establishing the potential difference which is the grade to which an EL element emits light between opposite potential and power supply potential like a display period. However, since the whole subframe period turns into a period which actually emits light in this case, it is [-- It sets up so that it may become :2-(n-2):2-(n-1).] SF1:SF2:SF3 about the length of a subframe period. : -- :SF(n-1):SFn=20:2-1:2-2 : By the above-mentioned composition, the picture of high brightness is acquired compared with the drive method of not making an address period emitting light.

[0114] Next, the drive method which carries out an alternating current drive by the analog method of the ElectroLuminescent Display of the invention in this application shown in drawing 1 and drawing 2 is explained. In addition, refer to drawing 4 for a timing chart.

[0115] The structure of the pixel section of the ElectroLuminescent Display which carries out an alternating current drive by the analog method is the same as the ElectroLuminescent Display which carries out an alternating current drive by the digital method, and the gate signal line (G1-Gn) is connected to the gate electrode of TFT for switching which each pixel has. One side is connected to a source signal line (S1-Sn), and, as for the source field and drain field of TFT for switching which each pixel has, another side is connected to the gate electrode and capacitor of TFT for EL drive. Moreover, as for the source field and drain field of TFT for EL drive, one side is connected to the current supply line (V1-Vn) at the EL element which each pixel has [another side]. The capacitor by which each pixel has a current supply line (V1-Vn) is connected.

[0116] The timing chart at the time of carrying out the alternating current drive of the ElectroLuminescent Display by the analog method is shown in drawing 4 . The period

when one gate signal line is chosen is called one-line period. Moreover, a period until selection of all gate signal lines is completed is equivalent to an one-frame period. Since there are n gate signal lines in the case of the gestalt of this operation, n line periods are prepared during one frame.

[0117] In addition, in the ElectroLuminescent Display of the invention in this application, it is desirable to prepare 120 or more frame periods in 1 second, and it is desirable to display 60 or more pictures in 1 second. When the number of the pictures displayed in 1 second becomes less than 60, a flicker of pictures, such as a flicker, begins to be visually conspicuous.

[0118] The number of the line periods in an one-frame period also increases as the number of gradation increases, and you have to stop having to drive a drive circuit on high frequency.

[0119] The supply voltage line (V1-Vn) is first maintained at the power supply potential of OFF. In addition, in the alternating current drive of an analog method, the height of the power supply potential of OFF is the range in which an EL element does not emit light, and if it is the same as the height of a stationary potential, it is good. In addition, it is called EL driver voltage of OFF of EL driver voltage at this time. Although it is ideally desirable that it is 0V as for EL driver voltage of OFF, what is necessary is just the size which is the grade to which EL element 1506 does not emit light.

[0120] In the 1st line period (L1), the video signal of an analog is inputted into a source signal line (S1-Sn) in order. The gate signal is inputted into the gate signal line G1 in the 1st line period (L1). Therefore, since TFT for switching (1 1) is turned on (ON), the video signal of the analog inputted into the source signal line S1 is inputted into the gate electrode of TFT for EL drive (1 1) through TFT for switching (1 1).

[0121] And the potential of the current supply line V1 changes from the power supply potential of OFF to saturation power supply potential. In addition, in this specification, saturation power supply potential is potential which has the potential difference between stationary potentials in the grade to which an EL element emits light in an analog drive.

[0122] The amount of the current which flows the channel formation field of TFT for EL drive is controlled by the size of the voltage of the video signal of the analog inputted into the gate electrode. When in an analog drive the video signal of an analog is inputted into the gate electrode of TFT for EL drive and a source field or a drain field is maintained at saturation power supply potential, it considers as the power supply potential of ON of another potential. In addition, it is called EL driver voltage of ON of EL driver voltage at this time.

[0123] EL driver voltage of the ON by which the size was controlled by the video signal of the analog impressed to the gate electrode of TFT for EL drive (1 1) is applied to an EL element.

[0124] Next, the video signal of an analog is similarly inputted into the source signal line S2, and TFT for switching (2 1) is turned on. Therefore, the video signal of the analog inputted into the source signal line S2 is inputted into the gate electrode of TFT for EL drive (2 1) through TFT for switching (2 1).

[0125] Therefore, TFT for EL drive (2 1) will be in an ON state. And the potential of the current supply line V2 changes from the power supply potential of OFF to saturation power supply potential. Therefore, EL driver voltage of the ON by which the size was controlled by the video signal of the analog impressed to the gate electrode of TFT for EL drive (2 1) is impressed to an EL element.

[0126] After the input of the video signal of the analog to a source signal line (S1-Sn) ends to a repeat operation mentioned above, the 1st line period (L1) expires. And next the 2nd line period (L2) comes, and a gate signal is inputted into the gate signal line G2. And the video signal of an analog is inputted into a source signal line (S1-Sn) in order like the 1st line period (L1).

[0127] The video signal of an analog is inputted into the source signal line S1. Since TFT for switching (1 2) is turned on [it], the video signal of the analog inputted into the source signal line S1 is inputted into the gate electrode of TFT for EL drive (1 2) through TFT for switching (1 2).

[0128] Therefore, TFT for EL drive (1 2) will be in an ON state. And the potential of the current supply line V1 changes from the power supply potential of OFF to saturation power supply potential. Therefore, EL driver voltage by which the size was controlled by the video signal of the analog impressed to the gate electrode of TFT for EL drive (1 2) is impressed to an EL element.

[0129] After the input of the video signal of the analog to a source signal line (S1-Sn) ends to a repeat operation mentioned above, the 2nd line period (L2) expires. And next the 3rd line period (L3) comes, and a gate signal is inputted into gate signal line G3. And a gate signal is inputted into a gate signal line (G1-Gn) in order, and an one-frame period expires.

[0130] After this frame period expires, when saturation power supply potential changes in the next frame period, the power supply potential of ON changes. And EL driver voltage of ON changes to the voltage which has reverse polarity. and a previous frame period -- the same -- operation mentioned above is performed However, EL driver voltage of the ON in this frame period has the reverse polarity of EL driver voltage of

the ON in a previous frame period. Therefore, EL driver voltage of the ON which has polarity contrary to a previous frame period is applied [no] to EL elements, and an EL element emits light. In this specification, the frame period which does not display a picture for the frame period when an EL element displays a picture, without [a display frame period and] no EL elements emitting light conversely is called non-display frame period.

[0131] After a non-display frame period expires, display frame period another next comes and EL driver voltage changes to the voltage which has the reverse polarity of EL driver voltage in a non-display frame period.

[0132] Thus, a picture is displayed by repeating a display frame period and a non-display frame period by turns. The invention in this application is having the above-mentioned composition, and requires EL driver voltage of reverse polar ON for an EL element for every fixed period. Therefore, degradation of the current-voltage characteristic of an EL element is improved and it becomes possible to lengthen the life of an EL element compared with the conventional drive method.

[0133] Moreover, although the gestalt of this operation explained the example driven by the non-interlaced scan, the invention in this application can also be driven by the interlace.

[0134]

[Example] Below, the example of the invention in this application is explained.

[0135] (Example 1) By this example, when performing a time-sharing gradation display by the alternating current drive of a digital method, the example which changes EL driver voltage of ON for every subframe period at reverse polarity is explained. Here, the case where a n bit digital drive method performs the full color time-sharing gradation display of 2n gradation is explained.

[0136] The structure of the pixel section of the ElectroLuminescent Display in this example is the same as the structure shown in drawing 2 (B), and the gate signal line (G1-Gn) is connected to the gate electrode of TFT for switching which each pixel has. One side is connected to a source signal line (S1-Sn), and, as for the source field and drain field of TFT for switching which each pixel has, another side is connected to the gate electrode and capacitor of TFT for EL drive. Moreover, as for the source field and drain field of TFT for EL drive, one side is connected to the current supply line (V1-Vn) at the EL element which each pixel has [another side]. The capacitor by which each pixel has a current supply line (V1-Vn) is connected.

[0137] The timing chart of the drive method of this example is shown in drawing 5 . First, an one-frame period is divided during [n] the subframe (SF1-SFn). In addition,

all the pixels of the pixel section call the period which displays one picture one-frame period.

[0138] In addition, the period which divided the one-frame period into plurality further is called subframe period. The number of partitions of an one-frame period must also increase as the number of gradation increases, and you have to drive a drive circuit on high frequency.

[0139] One subframe period is divided into an address period (Ta) and a sustain period (Ts). An address period is time taken to input data into all pixels during the 1 subframe, and the sustain period (it is also called a lighting period) shows the period which makes an EL element emit light.

[0140] All the length of the address period (Ta1-Tan) which it has, respectively has n the same subframe periods (SF1-SFn). SF1-SFn set to Ts1-Tsn the sustain period (Ts) which it has, respectively, respectively.

[0141] The length of a sustain period is [-- It sets up so that it may become :2-(n-2):2-(n-1).] Ts1:Ts2:Ts3. : -- It is :Ts(n-1):Tsn=20:2-1:2-2. : However, you may carry out sequence of making SF1-SFn appearing, what. A desired gradation display can be performed among 2n gradation in the combination of this sustain period.

[0142] First, a counterelectrode is maintained at the stationary potential of OFF. And a gate signal is inputted into the gate signal line G1, and all TFT for switching by which the gate electrode is connected to the gate signal line G1 will be in the state of ON.

[0143] And in the state of ON of TFT for switching by which the gate electrode is connected to the gate signal line G1, a digital data signal is simultaneously inputted into all source signal lines (S1-Sn). And the digital data signal inputted into the source signal line (S1-Sn) is inputted into the gate electrode of TFT for EL drive through TFT for switching of the state of ON (ON). Moreover, a digital data signal is inputted also into a capacitor and it is held.

[0144] Operation mentioned above is repeated and a digital data signal is inputted into all pixels. A period until a digital data signal is inputted into all pixels is an address period.

[0145] A sustain period comes at the same time an address period expires. If a sustain period comes, the potential of a counterelectrode will change to the stationary potential of ON from the stationary potential of OFF. And TFT for switching is turned off and the digital data signal held in the capacitor is inputted into the gate electrode of TFT for EL drive.

[0146] In this example, the polarity of EL driver voltage of the ON which is the difference of the stationary potential of ON and power supply potential becomes reverse

for every subframe period by changing the height of the stationary potential of ON. Therefore, by making reverse polarity of EL driver voltage of ON in every subframe period, an ElectroLuminescent Display repeats a display and un-displaying. The subframe period which displays is called display subframe period, and the subframe period which does not display is called non-display subframe period.

[0147] For example, in the 1st frame period, supposing the 1st subframe period is a display period, the 2nd subframe period will be a non-display period, and the 3rd frame period will turn into a display period again. And if all subframe periods appear and the 1st frame period expires, the 2nd frame period will come. In the 1st subframe period in the 2nd frame period, since EL driver voltage which has polarity contrary to EL driver voltage applied to the EL element in the 1st subframe period within the 1st frame period is applied to EL layer of an EL element, it serves as a non-display period. And next, the 2nd subframe period turns into a display period, and turns into a display period and a non-display period by turns for every subframe period.

[0148] In addition, in this specification, the polarity of EL driver voltage calls the period when displaying display period, when a display and un-displaying change by the bird clapper conversely. Moreover, the period when not displaying conversely is called non-display period. Therefore, in this specification, a display frame period and a display subframe period are named generically, and it is called a display period. Moreover, a non-display frame period and a non-display subframe period are conversely named generically, and it is called a non-display period.

[0149] When the digital data signal has the information on "0" in this example, TFT for EL drive will be in an OFF state, and the pixel electrode of an EL element is maintained at the stationary potential of OFF. Consequently, the EL element which the pixel to which the digital data signal which has the information on "0" was added has does not emit light.

[0150] On the contrary, when it has the information on "1", TFT for EL drive will be in an ON state, and power supply potential is given to the pixel electrode of an EL element. Consequently, the EL element which the pixel as which the digital data signal which has the information on "1" was inputted has emits light.

[0151] The period all whose TFT for switching is OFF states is a sustain period.

[0152] The periods which make an EL element emit light (a pixel is made to turn on) are one to Ts1-Tsn of periods. Here, it carries out to having made the pixel of Tsn predetermined during the period turn on.

[0153] Next, it enters during the address again, and if a digital data signal is inputted into all pixels, it will enter during the sustain. At this time, the period of either Ts1-Ts

(n-1) turns into a sustain period. Here, it carries out to having made the pixel of Ts (n-1) predetermined during the period turn on.

[0154] The operation same about the n-2 remaining subframes is repeated hereafter, and they are Ts (n-2) and Ts (n-3) one by one. -- Ts1 and a sustain period are set up and it carries out to having made the pixel predetermined by each subframe turn on.

[0155] Thus, in the time-sharing gradation display of an alternating current drive, when applying to an EL element EL driver voltage which has reverse polarity for every subframe, one gradation display is performed in two frame periods. In two adjacent frame periods, the gradation of the pixel is decided by integrating the length of the sustain period immediately after the sustain period which the pixel had turned on, and the address period when the digital data signal which in other words has the information on "1" was inputted into the pixel. For example, when brightness when a pixel emits light in all sustain periods was made into 100% at the time of n= 8 and a pixel emits light in Ts1 and Ts2, 75% of brightness can be expressed, and when Ts3, and Ts5 and Ts8 are chosen, 16% of brightness can be expressed.

[0156] The invention in this application is having the above-mentioned composition, and requires reverse polar EL driver voltage for EL layer which an EL element has for every subframe period. Therefore, degradation of the current-voltage characteristic of an EL element is improved and it becomes possible to lengthen the life of an EL element compared with the conventional drive method.

[0157] In this example, the effect that a flicker cannot happen easily compared with the ElectroLuminescent Display of the digital method which carries out an alternating current drive for every frame period shown with the gestalt of operation is acquired.

[0158] (Example 2) By this example, another example is indicated to be the pixel section of the ElectroLuminescent Display of the invention in this application shown by drawing 2 (A).

[0159] A circuit diagram shows an example of the enlarged view of the pixel section of the ElectroLuminescent Display of this example to drawing 6 (A). Two or more pixels are arranged by the shape of a matrix at the pixel section. A pixel 603 and a pixel 604 adjoin and are prepared. In drawing 6 (A), 605 and 625 are TFT for switching. The gate electrode of TFT 605 and 625 for switching is connected to the gate signal line 606 which inputs a gate signal. Another side is connected to the gate electrode and capacitors 613 and 623 of TFT for EL drive at the data signal lines (it is also called a source signal line) 607 and 627 into which, as for the source field and drain field of TFT 605 and 625 for switching, one side inputs a digital data signal, respectively.

[0160] And the source field of TFT 608 and 628 for EL drive is connected to the common

current supply line 611, and a drain field is connected to the pixel electrode which EL elements 610 and 630 have, respectively. Thus, at this example, two adjacent pixels are sharing the current supply line.

[0161] EL elements 610 and 630 become in EL layer prepared between an anode plate (this example pixel electrode), cathode (this example counterelectrode), and an anode plate and cathode, respectively. In this example, the drain field of TFT 608 and 628 for EL drive is connected to the anode plate. It connects with the regular power supplies 612 and 622, and cathode is maintained at the stationary potential. The invention in this application may not be limited to this composition, but the drain field of TFT 608 and 628 for EL drive may be connected to cathode.

[0162] In addition, you may prepare a resistor, respectively between the drain field of TFT 608 and 628 for EL drive, and the anode plate (pixel electrode) which EL elements 610 and 630 have, respectively. By preparing a resistor, the amount of current supplied to an EL element from TFT for EL drive is controlled, and it becomes possible to prevent the influence of the variation in the property of TFT for EL drive. If a resistor is an element which shows resistance larger enough than the on resistance of TFT 608 and 628 for EL drive, since it is good, there will be no limitation in structure etc. In addition, an on resistance is the value which broke the drain voltage of TFT by the drain current which is flowing then, when TFT is an ON state. What is necessary is just to choose from the range of 1kohm-50M omega (preferably 10 k ohm - 10 M omega, still more preferably 50 k ohm - 1 M omega) as resistance of a resistor. When a semiconductor layer with resistance high as a resistor is used, formation is easy and desirable.

[0163] Moreover, when TFT 605 and 625 for switching is in the state (OFF state) where it does not choose, in order to hold the gate voltage of TFT 608 and 628 for EL drive, capacitors 613 and 633 are formed. One side is connected to the drain field of TFT 605 and 625 for switching, and another side is connected to the current supply line 611 for two electrodes which these capacitors 613 and 633 have. In addition, it is not necessary to necessarily form capacitors 613 and 633.

[0164] The concrete block diagram of the circuit diagram shown in drawing 6 (B) by drawing 6 (A) is shown. The pixel 603 and the pixel 604 are formed in the field surrounded by the source signal lines 607 and 627, the gate signal lines 606 and 616, and the current supply line 611. As for the source field of TFT 608 and 628 for EL drive which a pixel 603 and a pixel 604 have, respectively, both are connected to the current supply line 611. Thus, at this example, two adjacent pixels are sharing the current supply line. Thereby, compared with the composition shown by drawing 2 (A), the rate of the wiring to the whole pixel section can be made small. If the rate over the whole pixel

section of wiring is small, when wiring is formed in the direction in which EL layer emits light, cover of the light by wiring is suppressed.

[0165] It combines with an example 1 freely and composition shown in this example can be carried out.

[0166] (Example 3)

[0167] this example explains the outline of the cross-section structure of the ElectroLuminescent Display of the invention in this application using drawing 7 .

[0168] In drawing 7 , it is the insulator layer (henceforth a ground film) from which 11 becomes a substrate and 12 becomes a ground. As a substrate 11, a glass substrate, a quartz substrate, a crystallized-glass substrate, or a glass-ceramics substrate can be used for a translucency substrate and a representation target. However, you have to bear the highest processing temperature in a production process.

[0169] Moreover, although especially the ground film 12 is effective when using the substrate containing a movable ion, and the substrate which has conductivity, you may not prepare in a quartz substrate. What is necessary is just to use the insulator layer containing silicon (silicon) as a ground film 12. in addition, in this specification, "the insulator layer containing silicon" points out the insulator layer in which predetermined came out of oxygen or nitrogen comparatively, and it was made to specifically contain to silicon, such as an oxidization silicon film, a silicon nitride film, or a nitriding oxidization silicon film (SiOxNy:x and y -- arbitrary integers -- come out and shown)

[0170] 201 is TFT for switching, 202 is TFT for EL drive, and it is formed by n channel type TFT and p-channel type TFT, respectively. When the luminescence direction of EL is the inferior surface of tongue (field in which TFT and EL layer are not prepared) of a substrate, it is desirable that it is the above-mentioned composition. However, the invention in this application is not limited to this composition. N channel type TFT, p-channel type TFT, or neither is available for TFT for switching, and TFT for EL drive.

[0171] TFT201 for switching has a barrier layer including the source field 13, the drain field 14, the LDD fields 15a-15d, an isolation region 16, and the channel formation fields 17a and 17b, the gate insulator layer 18, the gate electrodes 19a and 19b, the insulator layer 20 between the 1st layer, the source signal line 21, and the drain wiring 22. In addition, the gate insulator layer 18 or the insulator layer 20 between the 1st layer may be common to all TFT on a substrate, and may be changed according to a circuit or an element.

[0172] Moreover, the gate electrodes 19a and 19b are connected electrically, and TFT201 for switching shown in drawing 7 has the so-called double-gate structure. Of course, you may be the so-called multi-gate structures (structure containing the barrier layer which

has two or more channel formation fields connected in series), such as not only double-gate structure but triple gate structure.

[0173] Multi-gate structure is very effective when reducing the OFF state current, and if the OFF state current of TFT for switching is made low enough, a minimum capacity which the capacitor connected so much to the gate electrode of TFT202 for EL drive needs can be stopped. That is, since area of a capacitor can be made small, considering as multi-gate structure is effective when extending the effective luminescence area of an EL element.

[0174] Furthermore, in TFT201 for switching, the LDD fields 15a-15d are formed so that it may not lap with the gate electrodes 19a and 19b through the gate insulator layer 18. Such structure is very effective when reducing the OFF state current. Moreover, what is necessary is just to set typically 0.5-3.5 micrometers (width of face) of LDD fields [15a-15d] length to 2.0-2.5 micrometers.

[0175] In addition, it is still more desirable to prepare an offset field (field where it becomes in the semiconductor layer of the same composition as a channel formation field, and a gate voltage is not applied) between a channel formation field and a LDD field when lowering the OFF state current. Moreover, in the case of the multi-gate structure of having two or more gate electrodes, the isolation region 16 (field where the same impurity element was added by the same concentration as a source field or a drain field) prepared between channel formation fields is effective for reduction of the OFF state current.

[0176] Next, TFT202 for EL drive has a barrier layer including the source field 26, the drain field 27, and the channel formation field 29, the gate insulator layer 18, the gate electrode 30, the insulator layer 20 between the 1st layer, and the source signal line 31 and the drain wiring 32, and is formed. In this example, TFT202 for EL drive is p-channel type TFT.

[0177] Moreover, the drain field 14 of TFT201 for switching is connected to the gate 30 of TFT202 for EL drive. Although not illustrated, the gate electrode 30 of TFT202 for EL drive is specifically electrically connected through the drain field 14 of TFT201 for switching, and the drain wiring (it can also be called connection wiring) 22. In addition, although the gate electrode 30 has single-gate structure, you may be multi-gate structure. Moreover, the source signal line 31 of TFT202 for EL drive is connected to a current supply line (not shown).

[0178] TFT202 for EL drive is an element for controlling the amount of current poured into an EL element, and comparatively much current flows. Therefore, as for channel width (W), it is desirable to design more greatly than the channel width of TFT for

switching. Moreover, as for channel length (L), designing for a long time is desirable so that superfluous current may not flow to TFT202 for EL drive. It is made to be desirably set to 0.5-2microper pixel A (preferably 1-1.5microA).

[0179] Furthermore, you may suppress degradation of TFT by what thickness of the barrier layer (especially channel formation field) of TFT202 for EL drive is thickened for (preferably 50-100nm, still more preferably 60-80nm). On the contrary, in the case of TFT201 for switching, if the OFF state current is seen from a viewpoint of making it small, what thickness of a barrier layer (especially channel formation field) is made thin also for (preferably 20-50nm, still more preferably 25-40nm) is effective.

[0180] Although the above explained the structure of TFT established in the pixel, a drive circuit is also simultaneously formed at this time. The CMOS circuit used as the base unit which forms a drive circuit is illustrated by drawing 7 .

[0181] TFT which has the structure of reducing hot carrier pouring is used as n channel type TFT204 of a CMOS circuit, making it not reduce a working speed as much as possible in drawing 7 . In addition, as a drive circuit here, a source signal side drive circuit and a gate signal side drive circuit are pointed out. Of course, it is also possible to form other logical circuits (a level shifter, an A/D converter, signal dividing network, etc.).

[0182] In the LDD field 37, the barrier layer of n channel type TFT204 of a CMOS circuit has lapped with the gate electrode 39 through the gate insulator layer 18 including the source field 35, the drain field 36, the LDD field 37, and the channel formation field 38.

[0183] The consideration for not reducing a working speed forms the LDD field 37 only in the drain field 36 side. Moreover, it is better for this n channel type TFT204 to seldom have cared about the OFF state current value, and to attach greater importance than to it to a working speed. Therefore, as for the LDD field 37, it is desirable to keep in a gate electrode in piles completely, and to lessen a resistance component as much as possible. Namely, it is better to abolish the so-called offset.

[0184] Moreover, since degradation by hot carrier pouring hardly worries p-channel type TFT205 of a CMOS circuit, it does not need to prepare especially a LDD field. Therefore, as for a barrier layer, on it, the gate insulator layer 18 and the gate electrode 43 are formed including the source field 40, the drain field 41, and the channel formation field 42. Of course, it is also possible to prepare a LDD field like n channel type TFT204, and to take the cure against a hot carrier.

[0185] Moreover, n channel type TFT204 and p-channel type TFT205 have [on the source field] the source signal lines 44 and 45 through the insulator layer 20 in between

between the 1st layer, respectively. Moreover, the drain field of n channel type TFT204 and p-channel type TFT205 is mutually connected electrically by the drain wiring 46.

[0186] 47 [next,] -- the 1st passivation film -- it is -- thickness -- 10nm - 1 micrometer (preferably 200-500nm) -- then, it is good As a material, the insulator layer (a nitriding oxidization silicon film or a silicon nitride film is especially desirable) containing silicon can be used. This passivation film 47 has the role metal which protects formed TFT from alkali metal or moisture. Alkali metal, such as sodium, is contained in EL layer finally prepared above TFT (especially TFT for EL drive). That is, the 1st passivation film 47 works also as a protective layer which does not make such alkali metal (movable ion) invade into the TFT side.

[0187] Moreover, 48 is an insulator layer between the 2nd layer, and has the function as a flattening film to perform flattening of the level difference made by TFT. Between the 2nd layer, as an insulator layer 48, an organic resin film is desirable and it is good to use a polyimide, a polyamide, an acrylic, BCB (benz-cyclo-butene), etc. These organic resin films tend to form a good flat side, and specific inductive capacity has an advantage of a low. Since EL layer is very sensitive to irregularity, as for the level difference by TFT, it is desirable to absorb almost by the insulator layer 48 between the 2nd layer. Moreover, when reducing the parasitic capacitance formed between a gate signal line, a data signal line, and the cathode of an EL element, it is desirable to prepare the low material of specific inductive capacity thickly. Therefore, 0.5-5 micrometers (preferably 1.5-2.5 micrometers) of thickness are desirable.

[0188] Moreover, 49 is a pixel electrode (anode plate of an EL element) which becomes by the transparent electric conduction film, and after it reaches insulator layer 48 between the 2nd layer and opens a contact hole (puncturing) in the 1st passivation film 47, it is formed so that it may connect with the drain wiring 32 of TFT202 for EL drive in the formed aperture. In addition, if the direct file of the pixel electrode 49 and the drain field 27 is made not to be carried out like drawing 7 , it can prevent the alkali metal of EL layer invading into a barrier layer via a pixel electrode.

[0189] On the pixel electrode 49, while [the 3rd layer] becoming by the oxidization silicon film, the nitriding oxidization silicon film, or the organic resin film, an insulator layer 50 is formed at the thickness which is 0.3-1 micrometer. Between this 3rd layer, the verge of opening **********s so that opening may be prepared by etching on the pixel electrode 49 and an insulator layer 50 may serve as a taper configuration. As for the angle of a taper, it is good to consider as 10-60 degrees (preferably 30-50 degrees).

[0190] On an insulator layer 50, the EL layer 51 is formed between the 3rd layer. It is better for luminous efficiency to use by the laminated structure, although the EL layer

51 was used by the monolayer or the laminated structure. Although generally formed on a pixel electrode in order of a hole-injection layer / electron hole transporting bed / luminous layer / electronic transporting bed, structure like an electron hole transporting bed / luminous layer / electronic transporting bed, or a hole-injection layer / electron hole transporting bed / luminous layer / electronic transporting bed / electron-injection layer is sufficient. In the invention in this application, which well-known structure may be used and fluorescence nature coloring matter etc. may be doped to EL layer.

[0191] As an organic EL material, the material indicated by the following U.S. patents or the open official report can be used, for example. U.S. Pat. No. 4,356,429 U.S. Pat. No. 4,539,507, U.S. Pat. No. 4,720,432 U.S. Pat. No. 4,769,292, U.S. Pat. No. 4,885,211 U.S. Pat. No. 4,950,950, U.S. Pat. No. 5,059,861 U.S. Pat. No. 5,047,687, U.S. Pat. No. 5,073,446 U.S. Pat. No. 5,059,862, U.S. Pat. No. 5,061,617 U.S. Pat. No. 5,151,629, U.S. Pat. No. 5,294,869 U.S. Pat. No. 5,294,870, JP,10-189525,A, JP,8-241048,A, JP,8-78159,A.

[0192] In addition, it roughly divides into an ElectroLuminescent Display and there are four colorization means of displaying. The method which forms three kinds of EL elements corresponding to R(red) G(green) B (blue), The method which combined the method which combined the EL element and light filter of white luminescence, blue, or the EL element and fluorescent substance (color conversion layer of fluorescence nature : CCM) of bluish green luminescence, the method which puts the EL element corresponding to RGB on cathode (counterelectrode) using a transparent electrode, ******.

[0193] The structure of drawing 2 is an example at the time of using the method which forms three kinds of EL elements corresponding to RGB. In addition, although only one pixel is illustrated to drawing 7 , the pixel of the same structure is formed corresponding to each color of red, green, or blue, and, thereby, color display can be performed.

[0194] It is not concerned with a luminescence method, but the invention in this application can be carried out, and can use all the four above-mentioned methods for the invention in this application. However, since afterglow may pose [a speed of response] a problem slow compared with EL, the method of a fluorescent substance which does not use a fluorescent substance is desirable. Moreover, it can say that it is more desirable not to, use the light filter used as the factor on which luminescence brightness is dropped if possible, either.

[0195] The cathode 52 of an EL element is formed on the EL layer 51. The material which contains the small magnesium (Mg), the lithium (Li), or calcium (calcium) of a

work function as cathode 52 is used. What is necessary is just to use the electrode which becomes preferably by MgAg (material which mixed Mg and Ag by Mg:Ag=10:1). A MgAgAl electrode, a LiAl electrode, and a LiFAl electrode are mentioned to others.

[0196] In addition, EL element 206 is formed of the pixel electrode (anode plate) 49, the EL layer 51, and cathode 52.

[0197] Although it is necessary to form individually the layered product which becomes by the EL layer 51 and cathode 52 by each pixel, since the EL layer 51 is very weak for moisture, the usual photolithography technology cannot be used for it. Therefore, it is desirable to form alternatively using physical mask material, such as a metal mask, by gaseous-phase methods, such as a vacuum deposition method, a spatter, and a plasma CVD method.

[0198] In addition, in the present condition, although it is also possible as a method of forming EL layer alternatively to use the ink-jet method, screen printing, or the spin coat method, since these cannot perform continuation formation of cathode, they can be said for the above-mentioned method to be more desirable.

[0199] Moreover, it is a protection electrode, and 53 is an electrode for connecting the cathode 52 of each pixel at the same time it protects cathode 52 from external moisture etc. as a protection electrode 53, aluminum (aluminum), copper (Cu), or silver (Ag) is included -- low -- it is desirable to use material [****] The thermolysis effect which eases generation of heat of EL layer is also expectable in this protection electrode 53.

[0200] 54 [moreover,] -- the 2nd passivation film -- it is -- thickness -- 10nm - 1 micrometer (preferably 200-500nm) -- then, it is good Although the purpose which forms the 2nd passivation film 54 has the main purpose which protects the EL layer 51 from moisture, it is also effective to give the thermolysis effect. However, since EL layer is weak with heat as mentioned above, it is desirable to form membranes if possible at low temperature (preferably temperature requirement from a room temperature to 120 degrees C). Therefore, it can be called the membrane formation method that a plasma CVD method, a spatter, a vacuum deposition method, the ion plating method, or the solution applying method (the spin coating method) is desirable.

[0201] In addition, all TFT illustrated by drawing 7 cannot be overemphasized by that you may have the polysilicon contest film used by the invention in this application as a barrier layer.

[0202] The invention in this application is not limited to the structure of the ElectroLuminescent Display of drawing 7 , and the structure of drawing 7 is only one of the desirable gestalten when carrying out the invention in this application.

[0203] It combines with an example 1 or an example 2 freely, and composition shown in this example can be carried out.

(Example 4)

[0204] this example explains an example different from drawing 7 using drawing 21 about the outline of the cross-section structure of the ElectroLuminescent Display of the invention in this application. this example explains the example using bottom gate type TFT to TFT.

[0205] In drawing 21 , it is the insulator layer (henceforth a ground film) from which 811 becomes a substrate and 812 becomes a ground. As a substrate 811, a glass substrate, a quartz substrate, a crystallized-glass substrate, or a glass-ceramics substrate can be used for a translucency substrate and a representation target. However, you have to bear the highest processing temperature in a production process.

[0206] Moreover, although especially the ground film 812 is effective when using the substrate containing a movable ion, and the substrate which has conductivity, you may not prepare in a quartz substrate. What is necessary is just to use the insulator layer containing silicon (silicon) as a ground film 812. in addition, in this specification, "the insulator layer containing silicon" points out the insulator layer in which predetermined came out of oxygen or nitrogen comparatively, and it was made to specifically contain to silicon, such as an oxidization silicon film, a silicon nitride film, or a nitriding oxidization silicon film (SiOxNy:x and y -- arbitrary integers -- come out and shown)

[0207] 8201 is TFT for switching, 8202 is TFT for EL drive, and it is formed by n channel type TFT and p-channel type TFT, respectively. When the luminescence direction of EL is the inferior surface of tongue (field in which TFT and EL layer are not prepared) of a substrate, it is desirable that it is the above-mentioned composition. However, the invention in this application is not limited to this composition. N channel type TFT, p-channel type TFT, or neither is available for TFT for switching, and TFT for EL drive.

[0208] TFT8201 for switching has a barrier layer including the source field 813, the drain field 814, the LDD fields 815a-815d, an isolation region 816, and the channel formation fields 863a and 864b, the gate insulator layer 818, the gate electrodes 819a and 819b, the insulator layer 820 between the 1st layer, the source signal line 821, and the drain wiring 822. In addition, the gate insulator layer 818 or the insulator layer 820 between the 1st layer may be common to all TFT on a substrate, and may be changed according to a circuit or an element.

[0209] Moreover, the gate electrodes 819a and 819b are connected electrically, and TFT8201 for switching shown in drawing 21 has the so-called double-gate structure. Of course, you may be the so-called multi-gate structures (structure containing the barrier layer which has two or more channel formation fields connected in series), such as not only double-gate structure but triple gate structure.

[0210] Multi-gate structure is very effective when reducing the OFF state current, and if the OFF state current of TFT for switching is made low enough, a minimum capacity which the capacitor connected so much to the gate electrode of TFT8202 for EL drive needs can be stopped. That is, since area of a capacitor can be made small, considering as multi-gate structure is effective when extending the effective luminescence area of an EL element.

[0211] Furthermore, in TFT8201 for switching, the LDD fields 815a-815d are formed so that it may not lap with the gate electrodes 819a and 819b through the gate insulator layer 818. Such structure is very effective when reducing the OFF state current. Moreover, what is necessary is just to set typically 0.5-3.5 micrometers (width of face) of LDD fields [815a-815d] length to 2.0-2.5 micrometers.

[0212] In addition, it is still more desirable to prepare an offset field (field where it becomes in the semiconductor layer of the same composition as a channel formation field, and a gate voltage is not applied) between a channel formation field and a LDD field when lowering the OFF state current. Moreover, in the case of the multi-gate structure of having two or more gate electrodes, the isolation region 816 (field where the same impurity element was added by the same concentration as a source field or a drain field) prepared between channel formation fields is effective for reduction of the OFF state current.

[0213] Next, TFT8202 for EL drive has a barrier layer including the source field 826, the drain field 827, and the channel formation field 805, the gate insulator layer 818, the gate electrode 830, the insulator layer 820 between the 1st layer, and the source signal line 831 and the drain wiring 832, and is formed. In this example, TFT8202 for EL drive is p-channel type TFT.

[0214] Moreover, the drain field 814 of TFT8201 for switching is connected to the gate 830 of TFT8202 for EL drive. Although not illustrated, the gate electrode 830 of TFT8202 for EL drive is specifically electrically connected through the drain field 814 of TFT8201 for switching, and the drain wiring (it can also be called connection wiring) 822. In addition, although the gate electrode 830 has single-gate structure, you may be multi-gate structure. Moreover, the source signal line 831 of TFT8202 for EL drive is connected to a current supply line (not shown).

[0215] TFT8202 for EL drive is an element for controlling the amount of current poured into an EL element, and comparatively much current flows. Therefore, as for channel width (W), it is desirable to design more greatly than the channel width of TFT for switching. Moreover, as for channel length (L), designing for a long time is desirable so that superfluous current may not flow to TFT8202 for EL drive. It is made to be desirably set to 0.5-2microper pixel A (preferably 1-1.5microA).

[0216] Furthermore, you may suppress degradation of TFT by what thickness of the barrier layer (especially channel formation field) of TFT8202 for EL drive is thickened for (preferably 50-100nm, still more preferably 60-80nm). On the contrary, in the case of TFT8201 for switching, if the OFF state current is seen from a viewpoint of making it small, what thickness of a barrier layer (especially channel formation field) is made thin also for (preferably 20-50nm, still more preferably 25-40nm) is effective.

[0217] Although the above explained the structure of TFT established in the pixel, a drive circuit is also simultaneously formed at this time. The CMOS circuit used as the base unit which forms a drive circuit is illustrated by drawing 21 .

[0218] TFT which has the structure of reducing hot carrier pouring is used as n channel type TFT8204 of a CMOS circuit, making it not reduce a working speed as much as possible in drawing 21 . In addition, as a drive circuit here, a source signal side drive circuit and a gate signal side drive circuit are pointed out. Of course, it is also possible to form other logical circuits (a level shifter, an A/D converter, signal dividing network, etc.).

[0219] In the LDD field 837, the barrier layer of n channel type TFT8204 of a CMOS circuit has lapped with the gate electrode 839 through the gate insulator layer 818 including the source field 835, the drain field 836, the LDD field 837, and the channel formation field 862.

[0220] The consideration for not reducing a working speed forms the LDD field 837 only in the drain field 836 side. Moreover, it is better for this n channel type TFT8204 to seldom have cared about the OFF state current value, and to attach greater importance than to it to a working speed. Therefore, as for the LDD field 837, it is desirable to keep in a gate electrode in piles completely, and to lessen a resistance component as much as possible. Namely, it is better to abolish the so-called offset.

[0221] Moreover, since degradation by hot carrier pouring hardly worries p-channel type TFT8205 of a CMOS circuit, it does not need to prepare especially a LDD field. Therefore, as for a barrier layer, on it, the gate insulator layer 818 and the gate electrode 843 are formed including the source field 840, the drain field 841, and the channel formation field 861. Of course, it is also possible to prepare a LDD field like n

channel type TFT8204, and to take the cure against a hot carrier.

[0222] In addition, 817a, 817b, 829, 838, and 842 are the masks for forming the channel formation fields 861, 862, 863, 864, and 805.

[0223] Moreover, n channel type TFT8204 and p-channel type TFT8205 have [on the source field] the source signal lines 844 and 845 through the insulator layer 820 in between between the 1st layer, respectively. Moreover, the drain field of n channel type TFT8204 and p-channel type TFT8205 is mutually connected electrically by the drain wiring 846.

[0224] 847 [next,] -- the 1st passivation film -- it is -- thickness -- 10nm - 1 micrometer (preferably 200-500nm) -- then, it is good As a material, the insulator layer (a nitriding oxidization silicon film or a silicon nitride film is especially desirable) containing silicon can be used. This passivation film 847 has the role metal which protects formed TFT from alkali metal or moisture. Alkali metal, such as sodium, is contained in EL layer finally prepared above TFT (especially TFT for EL drive). That is, the 1st passivation film 847 works also as a protective layer which does not make such alkali metal (movable ion) invade into the TFT side.

[0225] Moreover, 848 is an insulator layer between the 2nd layer, and has the function as a flattening film to perform flattening of the level difference made by TFT. Between the 2nd layer, as an insulator layer 848, an organic resin film is desirable and it is good to use a polyimide, a polyamide, an acrylic, BCB (benz-cyclo-butene), etc. These organic resin films tend to form a good flat side, and specific inductive capacity has an advantage of a low. Since EL layer is very sensitive to irregularity, as for the level difference by TFT, it is desirable to absorb almost by the insulator layer 848 between the 2nd layer. Moreover, when reducing the parasitic capacitance formed between a gate signal line, a data signal line, and the cathode of an EL element, it is desirable to prepare the low material of specific inductive capacity thickly. Therefore, 0.5-5 micrometers (preferably 1.5-2.5 micrometers) of thickness are desirable.

[0226] Moreover, 849 is a pixel electrode (anode plate of an EL element) which becomes by the transparent electric conduction film, and after it reaches insulator layer 848 between the 2nd layer and opens a contact hole (puncturing) in the 1st passivation film 847, it is formed so that it may connect with the drain wiring 832 of TFT8202 for EL drive in the formed aperture. In addition, if the direct file of the pixel electrode 849 and the drain field 827 is made not to be carried out like drawing 21 , it can prevent the alkali metal of EL layer invading into a barrier layer via a pixel electrode.

[0227] On the pixel electrode 849, while [the 3rd layer] becoming by the oxidization

silicon film, the nitriding oxidization silicon film, or the organic resin film, an insulator layer 850 is formed at the thickness which is 0.3-1 micrometer. Between this 3rd layer, the verge of opening **********s so that opening may be prepared by etching on the pixel electrode 849 and an insulator layer 850 may serve as a taper configuration. As for the angle of a taper, it is good to consider as 10-60 degrees (preferably 30-50 degrees).

[0228] On an insulator layer 850, the EL layer 851 is formed between the 3rd layer. It is better for luminous efficiency to use by the laminated structure, although the EL layer 851 was used by the monolayer or the laminated structure. Although generally formed on a pixel electrode in order of a hole-injection layer / electron hole transporting bed / luminous layer / electronic transporting bed, structure like an electron hole transporting bed / luminous layer / electronic transporting bed, or a hole-injection layer / electron hole transporting bed / luminous layer / electronic transporting bed / electron-injection layer is sufficient. In the invention in this application, which well-known structure may be used and fluorescence nature coloring matter etc. may be doped to EL layer.

[0229] The structure of drawing 21 is an example at the time of using the method which forms three kinds of EL elements corresponding to RGB. In addition, although only one pixel is illustrated to drawing 21 , the pixel of the same structure is formed corresponding to each color of red, green, or blue, and, thereby, color display can be performed. It is not concerned with a luminescence method but the invention in this application can be carried out.

[0230] The cathode 852 of an EL element is formed on the EL layer 851. The material which contains the small magnesium (Mg), the lithium (Li), or calcium (calcium) of a work function as cathode 852 is used. What is necessary is just to use the electrode which becomes preferably by MgAg (material which mixed Mg and Ag by Mg:Ag=10:1). A MgAgAl electrode, a LiAl electrode, and a LiFAl electrode are mentioned to others.

[0231] In addition, EL element 8206 is formed of the pixel electrode (anode plate) 849, the EL layer 851, and cathode 852.

[0232] Although it is necessary to form individually the layered product which becomes by the EL layer 851 and cathode 852 by each pixel, since the EL layer 851 is very weak for moisture, the usual photolithography technology cannot be used for it. Therefore, it is desirable to form alternatively using physical mask material, such as a metal mask, by gaseous-phase methods, such as a vacuum deposition method, a spatter, and a plasma CVD method.

[0233] In addition, in the present condition, although it is also possible as a method of

forming EL layer alternatively to use the ink-jet method, screen printing, or the spin coat method, since these cannot perform continuation formation of cathode, they can be said for the above-mentioned method to be more desirable.

[0234] Moreover, it is a protection electrode, and 853 is an electrode for connecting the cathode 852 of each pixel at the same time it protects cathode 852 from external moisture etc. as a protection electrode 853, aluminum (aluminum), copper (Cu), or silver (Ag) is included -- low -- it is desirable to use material [****] The thermolysis effect which eases generation of heat of EL layer is also expectable in this protection electrode 853.

[0235] 854 [moreover,] -- the 2nd passivation film -- it is -- thickness -- 10nm - 1 micrometer (preferably 200-500nm) -- then, it is good Although the purpose which forms the 2nd passivation film 854 has the main purpose which protects the EL layer 851 from moisture, it is also effective to give the thermolysis effect. However, since EL layer is weak with heat as mentioned above, it is desirable to form membranes if possible at low temperature (preferably temperature requirement from a room temperature to 120 degrees C). Therefore, it can be called the membrane formation method that a plasma CVD method, a spatter, a vacuum deposition method, the ion plating method, or the solution applying method (the spin coating method) is desirable.

[0236] In addition, all TFT illustrated by drawing 21 cannot be overemphasized by that you may have the polysilicon contest film used by the invention in this application as a barrier layer.

[0237] The invention in this application is not limited to the structure of the ElectroLuminescent Display of drawing 21 , and the structure of drawing 21 is only one of the desirable gestalten when carrying out the invention in this application.

[0238] It combines with an example 1 or an example 2 freely, and composition shown in this example can be carried out.

[0239] (Example 5) this example explains how to produce simultaneously TFT of the pixel section and the drive circuit section prepared around it. However, in order to simplify explanation, suppose that the CMOS circuit which is a base unit is illustrated about a drive circuit.

[0240] First, as shown in drawing 8 (A), the substrate 501 which prepared the ground film (not shown) in the front face is prepared. On glass ceramics, as a ground film, the laminating of the nitriding oxidization silicon film of 200nm ** is carried out, and the nitriding oxidization silicon film of 100nm ** is used in this example. At this time, it is good to make into 10 - 25wt% nitrogen concentration of the direction which touches a glass-ceramics substrate. Of course, you may form a direct element on a quartz

substrate, without preparing a ground film.

[0241] Next, the amorphous silicon film 502 with a thickness of 45nm is formed by the well-known forming-membranes method on a substrate 501. In addition, what is necessary is just the semiconductor film (a microcrystal semiconductor film is included) which does not need to limit to an amorphous silicon film and includes amorphous structure. The compound semiconductor film which furthermore includes the amorphous structure of an amorphous silicon germanium film etc. is sufficient.

[0242] The process from here to drawing 8 (C) can quote JP,10-247735,A by these people completely. In this official report, the technology about the crystallization method of a semiconductor film of having used elements, such as nickel, as a catalyst is indicated.

[0243] First, the protective coat 504 which has Openings 503a and 503b is formed. In this example, the oxidization silicon film of 150nm ** is used. And the layer (nickel content layer) 505 which contains nickel (nickel) by the spin coat method is formed on a protective coat 504. What is necessary is just to make the aforementioned official report reference about formation of this nickel content layer.

[0244] Next, as shown in drawing 8 (B), 570-degree-C heat-treatment of 14 hours is added in an inert atmosphere, and the amorphous silicon film 502 is crystallized. Under the present circumstances, crystallization advances to a substrate and outline parallel with the fields (henceforth nickel addition field) 506a and 506b as the starting point where nickel touched, and the polysilicon contest film 507 which becomes by the crystal structure with which the cylindrical crystal was gathered and located in a line is formed.

[0245] Next, as shown in drawing 8 (C), the element (preferably Lynn) which belongs to 15 groups by using a protective coat 504 as a mask as it is is added to nickel addition fields 506a and 506b. In this way, the fields (henceforth the Lynn addition field) 508a and 508b where Lynn was added are formed in high concentration.

[0246] Next, as shown in drawing 8 (C), 600-degree-C heat-treatment of 12 hours is added in an inert atmosphere. nickel which exists in the polysilicon contest film 507 with this heat treatment will move, and as an arrow finally shows all for almost, it will be captured to the Lynn addition fields 508a and 508b. This is considered to be a phenomenon by the gettering effect of the metallic element (this example nickel) by Lynn.

[0247] The concentration of nickel which remains into the polysilicon contest film 509 according to this process is reduced by even 2x1017 atoms/cm3 at least with the measured value by SIMS (mass secondary ion analysis). although nickel is a lifetime

killer for a semiconductor, if until reduction is carried out to this extent, it will not have a bad influence on a TFT property at all Moreover, since most of this concentration is the measurement limitation of the present SIMS analysis, it is thought in fact that it is low concentration (three or less 2x1017 atoms/cm) further.

[0248] In this way, the polysilicon contest film 509 reduced by even the level using the catalyst to which it crystallizes and the catalyst does not give trouble to operation of TFT is obtained. Then, the barrier layers 510-513 only using this polysilicon contest film 509 are formed according to a patterning process. Moreover, it is good at this time to form the marker for performing mask alignment in next patterning using the above-mentioned polysilicon contest film. (Drawing 8 (D))

[0249] Next, as shown in drawing 8 (E), the nitriding silicon-oxide film of 50nm ** is formed by the plasma CVD method, 950-degree-C heat-treatment of 1 hour is added in an oxidizing atmosphere on it, and a thermal oxidation process is performed. In addition, oxygen atmosphere is sufficient as an oxidizing atmosphere, and the oxygen atmosphere which added the halogen is sufficient as it.

[0250] At this thermal oxidation process, oxidization advances by the interface of a barrier layer and the above-mentioned nitriding silicon-oxide film, the polysilicon contest film of about 15nm ** oxidizes, and the silicon-oxide film of about 30nm ** is formed. That is, the gate insulator layer 514 of 80nm ** to which it comes to carry out the laminating of the silicon-oxide film of 30nm ** and the nitriding silicon-oxide film of 50nm ** is formed. Moreover, the thickness of barrier layers 510-513 is set to 30nm according to this thermal oxidation process.

[0251] Next, as shown in drawing 9 (A), the resist mask 515 is formed and the impurity element (henceforth p type impurity element) which gives p type to barrier layers 511-513 through the gate insulator layer 514 is added. Boron or a gallium can be used for the element and type target which belong to 13 groups typically as a p type impurity element. This process (it is called a channel dope process) is a process for controlling the threshold voltage of TFT.

[0252] In addition, in this example, boron is added by the ion doping method which carried out plasma excitation without carrying out mass separation of the diboron hexahydride (B-2 H6). Of course, you may use the ion implantation method for performing mass separation. The impurity ranges 516-518 which contain boron according to this process by the concentration of 1x1015 - 1x1018 atoms/cm3 (typically 5x1016 - 5x1017 atoms/cm3) are formed.

[0253] Next, as shown in drawing 9 (B), the resist masks 519a and 519b are formed, and the impurity element (henceforth n type impurity element) which gives n type

through the gate insulator layer 514 is added. In addition, Lynn or arsenic can be used for the element and type target which belong to 15 groups typically as an n type impurity element. In addition, in this example, Lynn is added by the concentration of 1x1018 atoms/cm3 using the plasma doping method which carried out plasma excitation without carrying out mass separation of the phosphoretted hydrogen (PH3). Of course, you may use the ion implantation method for performing mass separation.

[0254] To n type impurity ranges 520 and 521 formed of this process, a dose is adjusted so that n type impurity element may be contained by the concentration of 2x1016 - 5x1019 atoms/cm3 (typically 5x1017 - 5x1018 atoms/cm3).

[0255] Next, as shown in drawing 9 (C), the activation process of added n type impurity element and p type impurity element is performed. Although it is not necessary to limit an activation means, since the gate insulator layer 514 is formed, the furnace annealing processing using the electric heat furnace is desirable. Moreover, since the damage may be given to the barrier layer / gate insulator layer interface of the portion which serves as a channel formation field at the process of drawing 9 (A), it is desirable to heat-treat at as high temperature as possible.

[0256] Since heat-resistant high glass ceramics are used in the case of this example, 800-degree-C processing [furnace annealing] of 1 hour performs an activation process. In addition, you may oxidize thermally by making processing atmosphere into an oxidizing atmosphere, and may heat-treat by the inert atmosphere.

[0257] The boundary section (joint) with the field (p type impurity range formed at the process of drawing 9 (A)) which has not added n type impurity element which exists in the edge of n type impurity ranges 520 and 521, i.e., the circumference of n type impurity ranges 520 and 521, according to this process becomes clear. This means that a LDD field and a channel formation field can form a very good joint, when TFT is completed behind.

[0258] Next, patterning of the electric conduction film of 200-400nm ** is formed and carried out, and the gate electrodes 522-525 are formed. The length of the channel length of each TFT is determined by line breadth of these gate electrodes 522-525.

[0259] In addition, although a gate electrode may be formed by the electric conduction film of a monolayer, it is desirable to consider as cascade screens, such as a bilayer and three layers, if needed. An electric conduction film well-known as a material of a gate electrode can be used. Specifically Aluminum (aluminum), a tantalum (Ta), titanium (Ti), Molybdenum (Mo), a tungsten (W), chromium (Cr), the film that becomes by the element chosen from silicon (Si), or the film (typical -- a tantalum-nitride film and a nitriding tungsten film --) which becomes by the nitride of the aforementioned

element A titanium-nitride film, the alloy film (typically a Mo-W alloy, a Mo-Ta alloy) which combined the aforementioned element, or the silicide film (typically a tungsten silicide film, a titanium silicide film) of the aforementioned element can be used. Of course, even if it uses by the monolayer, a laminating may be carried out and you may use.

[0260] In this example, the cascade screen which becomes by the nitriding tungsten (WN) film of 50nm ** and the tungsten (W) film of 350nm ** is used. What is necessary is just to form this by the spatter. Moreover, if inert gas, such as a xenon (Xe) and neon (Ne), is added as spatter gas, film peeling by stress can be prevented.

[0261] Moreover, at this time, the gate electrodes 523 and 525 are formed so that it may lap through the part and the gate insulator layer 514 of n type impurity ranges 520 and 521, respectively. This overlapping portion serves as a LDD field which lapped with the gate electrode behind. In addition, the gate electrodes 524a and 524b are electrically connected in practice, although it is visible to two in a cross section.

[0262] Next, as shown in drawing 10 (A), n type impurity element (this example Lynn) is added on a self-adjustment target by using the gate electrodes 522-525 as a mask. In this way, to the impurity ranges 527-533 formed, it adjusts so that Lynn may be added by the concentration of 1 / 2 - 1/10 of n type impurity ranges 520 and 521 (typically 1 / 3 - 1/4). Specifically, the concentration of 1x1016 - 5x1018 atoms/cm3 (typically 3x1017 - 3x1018 atoms/cm3) is desirable.

[0263] Next, as shown in drawing 10 (B), the resist masks 534a-534d are formed for a gate electrode etc. with a wrap form, and the impurity ranges 535-541 which add n type impurity element (this example Lynn), and include Lynn in high concentration are formed. It carries out by the ion doping method for having used the phosphoretted hydrogen (PH3) also here, and the concentration of Lynn of this field is adjusted so that it may become 1x1020 - 1x1021 atoms/cm3 (typically 2x1020 - 5x1021 atoms/cm3).

[0264] Although the source field or drain field of n channel type TFT is formed of this process, TFT for switching leaves a part of n type impurity ranges 530-532 formed at the process of drawing 10 (A). This left-behind field is equivalent to the LDD field of TFT for switching.

[0265] Next, as shown in drawing 10 (C), the resist masks 534a-534c are removed, and the resist mask 543 is newly formed. And p type impurity element (this example boron) is added, and the impurity ranges 544 and 545 which contain boron in high concentration are formed. Here, boron is added so that it may become 3x1020 - 3x1021 atoms/cm3 (typically 5x1020 - 1x1021 atoms/cm3 NO) concentration by the

ion doping method for having used the diboron hexahydride (B-2 H6).

[0266] In addition, although Lynn is already added by impurity ranges 544 and 545 by the concentration of 1x1020 - 1x1021 atoms/cm3, the boron added here is added by the concentration of at least 3 times or more. Therefore, it is completely reversed to P type, and the n type impurity range currently formed beforehand functions as an impurity range of P type.

[0267] Next, as shown in drawing 10 (D), after removing the resist mask 543, an insulator layer 546 is formed between the 1st layer. What is necessary is just to use the cascade screen which used the insulator layer containing silicon by the monolayer, or was combined in it as an insulator layer 546 between the 1st layer. Moreover, thickness is just 400nm - 1.5 micrometers. In this example, it considers as the structure which carried out the laminating of the oxidization silicon film of 800nm ** on the nitriding oxidization silicon film of 200nm **.

[0268] Then, n type or p type impurity element added by each concentration is activated. As an activation means, the furnace annealing method is desirable. In this example, 550 degrees C and heat treatment of 4 hours are performed among nitrogen-gas-atmosphere mind in an electric heat furnace.

[0269] Furthermore, in the atmosphere containing 3 - 100% of hydrogen, heat treatment of 1 - 12 hours is performed at 300-450 degrees C, and a hydrogen treating is performed. This process is a process which carries out hydrogen termination of the azygos joint hand of a semiconductor film by the hydrogen excited thermally. As other meanses of hydrogenation, you may perform plasma hydrogenation (the hydrogen excited by plasma is used).

[0270] In addition, while forming an insulator layer 546 between the 1st layer, you may put in a hydrogen treating. That is, after forming the nitriding oxidization silicon film of 200nm **, a hydrogen treating may be performed as mentioned above, and it may remain after that, and the oxidization silicon film of 800nm ** may be formed.

[0271] Next, as shown in drawing 11 (A), a contact hole is formed to an insulator layer 546 between the 1st layer, and the source signal lines 547-550 and the drain wiring 551-553 are formed. In addition, it considers as the cascade screen of the three-tiered structure which carried out the aluminum film which contains [this electrode] 100nm and Ti for Ti film by 300nm at this example, and carried out continuation formation of the 150nm of the Ti films by the spatter. Of course, other electric conduction films are sufficient.

[0272] Next, the 1st passivation film 554 is formed by the thickness of 50-500nm (typically 200-300nm). In this example, the nitriding silicon-oxide film of 300nm ** is

used as the 1st passivation film 554. You may substitute a silicon nitride film for this.

[0273] At this time, it is effective to perform plasma treatment using the gas which contains H2 and NH3 grade hydrogen in advance of formation of a nitriding silicon-oxide film. The membraneous quality of the 1st passivation film 554 is improved because the hydrogen excited by this pretreatment heat-treats by supplying an insulator layer 546 between the 1st layer. Since the hydrogen added by the insulator layer 546 between the 1st layer is spread in a lower layer side simultaneously with it, a barrier layer can be hydrogenated effectively.

[0274] Next, as shown in drawing 11 (B), while [the 2nd layer] consisting of an organic resin, an insulator layer 555 is formed. As an organic resin, a polyimide, an acrylic, BCB (benz-cyclo-butene), etc. can be used. Between the 2nd layer, since especially the insulator layer 555 needs to carry out flattening of the level difference which TFT forms, its acrylic film excellent in flat nature is desirable. At this example, an acrylic film is formed by the thickness of 2.5 micrometers.

[0275] The contact hole which reaches the drain wiring 553 is formed in an insulator layer 555 and the 1st passivation film 554 between the 2nd layer, and, next, the protection electrode 556 is formed. What is necessary is just to use the electric conduction film which makes aluminum a principal component as a protection electrode 556. What is necessary is just to form the protection electrode 556 by the vacuum deposition method.

[0276] Next, the insulator layer (this example oxidization silicon film) containing silicon is formed in the thickness of 500nm, opening is formed in the position corresponding to the portion used as a pixel electrode, and an insulator layer 557 is formed between the 3rd layer. In case opening is formed, it can consider as the side attachment wall of a taper configuration easily by using the wet etching method. If the side attachment wall of opening is not fully gently-sloping, degradation of EL layer resulting from a level difference will pose a remarkable problem.

[0277] Next, the counterelectrode (MgAg electrode) 558 which is the cathode of an EL element is formed. Using a vacuum deposition method, the MgAg electrode 558 is formed so that it may be thin to 180-300nm (typically 200-250nm).

[0278] Next, the EL layer 559 is formed without carrying out air release using a vacuum deposition method. In addition, the thickness of the EL layer 559 should just make 80-200nm (typically 100-120nm) and the pixel electrode (anode plate) 560 the thickness of 110nm.

[0279] At the thing process in this example, EL layer and a pixel electrode (anode plate) are formed one by one to the pixel corresponding to red, the pixel which

corresponds green, and the pixel which corresponds blue. however, the ** which does not use photolithography technology since EL layer is lacking in the resistance over a solution -- each color -- you have to form individually Then, it is desirable that hide except a desired pixel using a metal mask, and only a required part forms EL layer and a pixel electrode (anode plate) alternatively.

[0280] That is, the mask which hides except [all] the pixel corresponding to red first is set, and EL layer and the pixel electrode (anode plate) of red luminescence are alternatively formed using the mask. Subsequently, the mask which hides except [all] the pixel which corresponds green is set, and EL layer and the pixel electrode (anode plate) of green luminescence are alternatively formed using the mask. Subsequently, the mask which hides except [all] the pixel which corresponds blue similarly is set, and EL layer and the pixel electrode (anode plate) of blue luminescence are alternatively formed using the mask. In addition, although it has indicated that a mask which is altogether different here is used, you may use the same mask about. Moreover, processing without breaking a vacuum is desirable until it forms EL layer and a pixel electrode (anode plate) in all pixels.

[0281] In addition, a material well-known as an EL layer 559 can be used. As a well-known material, when driver voltage is taken into consideration, it is desirable to use an organic material. For example, what is necessary is just to let four layer structures which become in a hole-injection layer, an electron hole transporting bed, a luminous layer, and an electron-injection layer be EL layers. Moreover, in this example, an indium-tin-oxide (ITO) film is formed as a pixel electrode (anode plate) 560 of an EL element. Moreover, the transparent electric conduction film which mixed 2 - 20% of zinc oxide (ZnO) may be used for indium oxide, and you may be well-known other materials.

[0282] The 2nd passivation film 561 which becomes the last by the silicon nitride film is formed in the thickness of 300nm.

[0283] In this way, the ElectroLuminescent Display of structure as shown in drawing 11 (C) is completed. In addition, in fact, when completing to drawing 11 (C), it is desirable to carry out packaging (enclosure) by housing material, such as airtight high protection films (a laminate film, ultraviolet-rays hardening resin film, etc.) and a sealing can made from ceramics, so that the open air may not ** further. In that case, the interior of housing material is made into an inert atmosphere, or the reliability (life) of EL layer improves by arranging a hygroscopic material (for example, barium oxide) inside.

[0284] Moreover, if processing of packaging etc. raises airtightness, the connector

(flexible print circuit : FPC) for connecting the terminal and external signal terminal which were taken about from the element formed on the substrate or the circuit will be attached, and it will complete as a product. The ElectroLuminescent Display changed into such a state where it can ship is called EL module in this specification.

[0285] It combines with an example 1 or an example 2 freely, and composition shown in this example can be carried out.

[0286] (Example 6)

[0287] this example explains the composition of the ElectroLuminescent Display of the invention in this application using the perspective diagram of drawing 12 .

[0288] The ElectroLuminescent Display of this example consists of the pixel section 3202 formed on the glass substrate 3201, a gate signal side drive circuit 3203, and a source side drive circuit 3204. TFT3205 for switching of the pixel section 3202 is n channel type TFT, and is arranged at the intersection of the gate signal line 3206 connected to the gate signal side drive circuit 3203, and the source signal line 3207 connected to the source side drive circuit 3204. Moreover, the drain field of TFT3205 for switching is connected to the gate of TFT3208 for EL drive.

[0289] Furthermore, the source field of TFT3208 for EL drive is connected to the current supply line 3209. Moreover, the capacitor 3216 connected to the gate field and the current supply line 3209 of TFT3208 for EL drive is formed. Power supply potential is applied to the current supply line 3209 in this example. Moreover, the counterelectrode (this example cathode) of this EL element 3211 is maintained at the stationary potential (this example 0 V).

[0290] And the I/O wiring (connection wiring) 3213 and 3214 for transmitting a signal to a drive circuit and the I/O wiring 3215 connected to the current supply line 3209 are formed in FPC3212 used as an external I/O terminal.

[0291] Furthermore, EL module of this example also including housing material is explained using drawing 13 (A) and (B). In addition, the sign used by drawing 12 if needed will be quoted.

[0292] On the glass substrate 3201, the pixel section 3202, the gate signal side drive circuit 3203, and the source signal side drive circuit 3204 are formed. The various wiring from each drive circuit results in FPC3212 through the I/O wiring 3213-3215, and is connected to an external instrument.

[0293] this time -- at least -- the pixel section 3202 -- as the drive circuits 3203 and 3204 and the pixel section 3202 are surrounded preferably, the housing material 3304 is formed In addition, outside an EL element, rather than **, inside dimension is the configuration or the sheet configuration of having a large crevice, and with adhesives

3305, as the housing material 3304 forms a closed space in collaboration with a glass substrate 3201, it fixes to a glass substrate 3201. At this time, an EL element will be in the state where it was completely enclosed with the aforementioned closed space, and will be completely intercepted from the open air. In addition, you may form two or more housing material 3304.

[0294] Moreover, the quality of the material of the housing material 3304 has desirable insulating matter, such as glass and polymer. For example, amorphous glass (******** glass, quartz, etc.), glass ceramics, ceramic glass, organic system resins (an acrylic resin, a styrene resin, a polycarbonate system resin, epoxy system resin, etc.), and a silicone system resin are mentioned. Moreover, you may use ceramics. Moreover, it is also possible to use metallic materials, such as an oak stainless alloy whose adhesives 3305 are insulating matter.

[0295] Moreover, the quality of the material of adhesives 3305 can use adhesives, such as an epoxy system resin and an acrylate system resin. Furthermore, thermosetting resin and a photoresist can also be used as adhesives. However, it is required to be the quality of the material which does not penetrate oxygen and moisture as much as possible.

[0296] Furthermore, as for the opening 3306 between the housing material 3304 and a glass substrate 3201, it is desirable to be filled up with inert gas (an argon, helium, nitrogen, etc.). Moreover, it is possible not only gas but to use inactive liquids (representing [by the perfluoro alkane] liquefied fluoridation carbon etc.). It is good with material which is used by JP,8-78519,A about the inactive liquid.

[0297] Moreover, it is also effective in an opening 3306 to prepare a drying agent. Material which is indicated by JP,9-148066,A as a drying agent can be used. Generally, the barium oxide is used.

[0298] Moreover, as shown in drawing 13 (B), two or more pixels which have the EL element isolated separately are prepared in the pixel section, and they all have the protection electrode 3307 as a common electrode. Although [this example] it is desirable to carry out continuation formation without carrying out air release of EL layer, cathode (MgAg electrode), and the protection electrode, you may form EL layer and cathode using the same mask material.

[0299] It is not necessary to prepare EL layer and cathode on a drive circuit that what is necessary is to prepare only on the pixel section at this time. Of course, it is more desirable not to prepare, if it takes into consideration that alkali metal is contained in EL layer, although it does not become a problem even if prepared on the drive circuit.

[0300] In addition, the protection electrode 3307 is connected to the I/O wiring 3310

in the field shown by 3308 through the connection wiring 3309 which becomes with the same material as a pixel electrode. The I/O wiring 3310 is a current supply line for applying power supply potential to the protection electrode 3307, and is connected to FPC3212 through the conductive paste material 3311.

[0301] It combines with an example 1 freely and composition shown in this example can be carried out.

[0302] (Example 7) this example explains the composition of the pixel of the ElectroLuminescent Display in the invention in this application.

[0303] Two or more pixels are arranged by the shape of a matrix at the pixel section of the ElectroLuminescent Display in the invention in this application. An example of the circuit diagram of a pixel is shown in drawing 17 (A). In drawing 17 (A), TFT1001 for switching is formed in the pixel 1000. In addition, in the invention in this application, TFT1001 for switching can use n channel type TFT, p-channel type TFT, or either. N channel type TFT is used for TFT1001 for switching in drawing 17 (A). The gate electrode of TFT1001 for switching is connected to the gate signal line 1002 which inputs a gate signal. The source field and drain field of TFT1001 for switching are connected to the data signal line (it is also called a source signal line) 1003 into which one side inputs an analog or a digital video signal. Moreover, another side is connected to the gate electrode of TFT1004 for EL drive.

[0304] One side is connected to the current supply line 1005 for the source field and drain field of TFT1004 for EL drive, and a drain field is connected to EL element 1006 for another side.

[0305] EL element 1006 becomes in EL layer prepared between an anode plate, cathode, and an anode plate and cathode. In addition, in the invention in this application, when an anode plate is [cathode] a counterelectrode in a pixel electrode, the source field or drain field of TFT1004 for EL drive is connected to the anode plate of EL element 1006. Conversely, by the counterelectrode, as for the source field or drain field of TFT1004 for EL drive, cathode is connected to the cathode of EL element 1006 for it, when an anode plate is a pixel electrode. In addition, although TFT1004 for EL drive can use n channel type TFT, p-channel type TFT, or either, when the anode plate of EL element 1006 is [cathode] a counterelectrode in a pixel electrode, it is desirable [TFT1004 for EL drive] that it is p-channel type TFT. Moreover, when the anode plate of EL element 1006 is [cathode] a pixel electrode in a counterelectrode conversely, as for TFT1004 for EL drive, it is desirable that it is n channel type TFT. In drawing 17 (A), p-channel type TFT is used for TFT1004 for EL drive, and the cathode of EL element 1006 is connected to the regular power supply

1007.

[0306] Moreover, a LDD field may be prepared into the barrier layer of TFT1004 for EL drive, and the field (Lov field) with which a LDD field and a gate electrode lap through a gate insulator layer may be formed. When especially TFT1004 for EL drive is n channel type TFT, the ON state current can be made to increase by forming a Lov field in the drain field side of a barrier layer, and capacity can be formed between the gate electrode of TFT1004 for EL drive, and a Lov field.

[0307] Moreover, when TFT1001 for switching is in the state (state of OFF) where it does not choose, in order to hold the gate voltage of TFT1004 for EL drive, you may form a capacitor. When forming a capacitor, a capacitor is connected between the current supply lines 1005 the direction which is not connected to the source signal line of the source field of TFT1001 for switching, and a drain field. In the circuit diagram shown in drawing 17 (A), the current supply line 1005 is located in a line in parallel with the source signal line 1003.

[0308] When the thickness of 22micrometerx22micrometer and a gate insulator layer is [the specific inductive capacity of 800A and a gate insulator layer] 4.1 for the size of a pixel in order to use the Lov field of TFT for EL drive as a capacitor for holding the gate voltage of TFT1004 for EL drive for example, the capacity value of about 19.8 fF(s) is required. Therefore, the area (area with which a LDD field and a gate electrode lap through a gate insulator layer) of a Lov field is needed about 66-micrometer2.

[0309] In addition, in the circuit diagram shown in drawing 17 (A), it is good also considering TFT1001 for switching, or TFT1004 for EL drive as multi-gate structure (structure containing the barrier layer which has two or more channel formation fields connected in series). The circuit diagram of the pixel which made TFT1001 for switching of the pixel shown in drawing 17 (A) multi-gate structure is shown in drawing 18 (A).

[0310] TFT1101a for switching and TFT1101b for switching connect in series, and are prepared. The circuit diagram and composition which were shown in drawing 17 (A) are the same except TFT1101a for switching, and 1101b. The OFF state current can be lowered by making TFT for switching into multi-gate structure. In addition, although considered as double-gate structure in drawing 18 (A), this example is not limited to DABURUGETO and should just be multi-gate structure.

[0311] Moreover, although not shown in drawing, when TFT for EL drive is made into multi-gate structure, degradation of TFT for EL drive by heat can be suppressed.

[0312] Next, another example of the circuit diagram of the pixel of the invention in this application is shown in drawing 17 (B). In drawing 17 (B), TFT1101 for switching is

formed in the pixel 1100. In addition, in the invention in this application, TFT1101 for switching can use n channel type TFT, p-channel type TFT, or either. N channel type TFT is used for TFT1101 for switching in drawing 17 (B). The gate electrode of TFT1101 for switching is connected to the gate signal line 1102 which inputs a gate signal. The source field of TFT1101 for switching or the drain field is connected to the data signal line (it is also called a source signal line) 1103 which inputs an analog or a digital video signal. Moreover, another side is connected to the gate electrode of TFT1104 for EL drive.

[0313] And one side is connected to the current supply line 1105 for the source field and drain field of TFT1104 for EL drive, and another side is connected to EL element 1106.

[0314] EL element 1106 becomes in EL layer prepared between an anode plate, cathode, and an anode plate and cathode. In addition, in the invention in this application, when an anode plate is [cathode] a counterelectrode in a pixel electrode, the source field or drain field of TFT1104 for EL drive is connected to the anode plate of EL element 1106. Conversely, by the counterelectrode, as for the source field or drain field of TFT1104 for EL drive, cathode is connected to the cathode of EL element 1106 for it, when an anode plate is a pixel electrode. In addition, although TFT1104 for EL drive can use n channel type TFT, p-channel type TFT, or either, when the anode plate of EL element 1106 is [cathode] a counterelectrode in a pixel electrode, it is desirable [TFT1104 for EL drive] that it is p-channel type TFT. Moreover, when the anode plate of EL element 1106 is [cathode] a pixel electrode in a counterelectrode conversely, as for TFT1104 for EL drive, it is desirable that it is n channel type TFT. In drawing 17 (B), p-channel type TFT is used for TFT1104 for EL drive, and the cathode of EL element 1106 is connected to the regular power supply 1107.

[0315] Moreover, a LDD field may be prepared into the barrier layer of TFT1104 for EL drive, and the field (Lov field) with which a LDD field and a gate electrode lap through a gate insulator layer may be formed. When especially TFT1104 for EL drive is n channel type TFT, the ON state current can be made to increase by forming a Lov field in the drain field side of a barrier layer, and capacity can be formed between the gate electrode of TFT1104 for EL drive, and a Lov field.

[0316] Moreover, when TFT1101 for switching is in the state (state of OFF) where it does not choose, in order to hold the gate voltage of TFT1104 for EL drive, you may form a capacitor. When forming a capacitor, a capacitor is connected between the current supply lines 1105 the direction which is not connected to the source signal

line of the source field of TFT1101 for switching, and a drain field. In the circuit diagram shown in drawing 17 (B), the current supply line 1105 is located in a line in parallel with the gate signal line 1102.

[0317] In addition, in the circuit diagram shown in drawing 17 (B), it is good also considering TFT1101 for switching, or TFT1104 for EL drive as multi-gate structure. The circuit diagram of the pixel which made TFT1101 for switching of the pixel shown in drawing 17 (B) multi-gate structure is shown in drawing 18 (B).

[0318] TFT1101a for switching and TFT1101b for switching connect in series, and are prepared. The circuit diagram and composition which were shown in drawing 17 (B) are the same except TFT1101a for switching, and 1101b. The OFF state current can be lowered by making TFT for switching into multi-gate structure. In addition, although considered as double-gate structure in drawing 18 (B), this example is not limited to DABURUGETO and should just be multi-gate structure.

[0319] Moreover, although not shown in drawing, when TFT for EL drive is made into multi-gate structure, degradation of TFT for EL drive by heat can be suppressed.

[0320] Next, another example of the circuit diagram of the pixel of the invention in this application is shown in drawing 19 (A). In drawing 19 (A), a pixel 1200 and a pixel 1210 adjoin and are prepared. In drawing 19 (A), 1201 and 1211 are TFT for switching. In addition, in the invention in this application, TFT 1201 and 1211 for switching can use n channel type TFT, p-channel type TFT, or either. N channel type TFT is used for TFT 1201 and 1211 for switching in drawing 19 (A). The gate electrode of TFT 1201 and 1211 for switching is connected to the gate signal line 1202 which inputs a gate signal. The source field and drain field of TFT 1201 and 1211 for switching are connected to the data signal lines (it is also called a source signal line) 1203 and 1204 into which one side inputs an analog or a digital video signal, respectively. Moreover, another side is connected to the gate electrode of TFT 1204 and 1214 for EL drive, respectively.

[0321] And one side of the source field of TFT 1204 and 1214 for EL drive and a drain field is connected to the current supply line 1220, and another side is connected to EL elements 1205 and 1215, respectively. Thus, at this example, two adjacent pixels are sharing one current supply line 1220. Thereby, the number of current supply lines can be reduced compared with the composition shown by drawing 17 and drawing 18 . If the rate over the whole pixel section of wiring is small, when wiring is formed in the direction in which EL layer emits light, cover of the light by wiring is suppressed.

[0322] EL elements 1205 and 1215 become in EL layer prepared between an anode plate, cathode, and an anode plate and cathode, respectively. In addition, in the

invention in this application, when an anode plate is [cathode] a counterelectrode in a pixel electrode, the source field or drain field of TFT 1204 and 1214 for EL drive is connected to the anode plate of EL elements 1205 and 1215. Conversely, by the counterelectrode, as for the source field or drain field of TFT 1204 and 1214 for EL drive, cathode is connected to the cathode of EL elements 1205 and 1215 for it, when an anode plate is a pixel electrode. In addition, although TFT 1204 and 1214 for EL drive can use n channel type TFT, p-channel type TFT, or either, when the anode plate of EL elements 1205 and 1215 is [cathode] a counterelectrode in a pixel electrode, it is desirable [TFT 1204 and 1214 for EL drive] that it is p-channel type TFT. Moreover, when the anode plate of EL elements 1205 and 1215 is [cathode] a pixel electrode in a counterelectrode conversely, as for TFT 1204 and 1214 for EL drive, it is desirable that it is n channel type TFT. In drawing 19 (A), p-channel type TFT is used for TFT 1204 and 1214 for EL drive, and the cathode of EL elements 1205 and 1215 is connected to the regular power supplies 1206 and 1216.

[0323] Moreover, a LDD field may be prepared into the barrier layer of TFT 1204 and 1214 for EL drive, and the field (Lov field) with which a LDD field and a gate electrode lap through a gate insulator layer may be formed. When especially TFT1204 for EL drive is n channel type TFT, the ON state current can be made to increase by forming a Lov field in the drain field side of a barrier layer, and capacity can be formed between the gate electrode of TFT1204 for EL drive, and a Lov field.

[0324] Moreover, when TFT 1201 and 1211 for switching is in the state (state of OFF) where it does not choose, in order to hold the gate voltage of TFT 1204 and 1214 for EL drive, you may form a capacitor. When forming a capacitor, a capacitor is connected between the current supply lines 1220 the direction which is not connected to the source signal line of the source field of TFT1201 for switching, and a drain field.

[0325] In addition, in the circuit diagram shown in drawing 19 (A), it is good also considering TFT 1201 and 1211 for switching, or TFT 1204 and 1214 for EL drive as multi-gate structure. The circuit diagram of the pixel which made TFT 1201 and 1211 for switching of the pixel shown in drawing 19 (A) multi-gate structure is shown in drawing 20 (A).

[0326] TFT1201a for switching and TFT1201b for switching connect in series, and are prepared. Moreover, TFT1211a for switching and TFT1211b for switching connect in series, and are prepared. The circuit diagram and composition which were shown in drawing 19 (A) are the same except TFT 1201a and 1201b for switching, TFT1211a for switching, and 1211b. The OFF state current can be lowered by making TFT for

switching into multi-gate structure. In addition, although considered as double-gate structure in drawing 20 (A), this example is not limited to DABURUGETO and should just be multi-gate structure.

[0327] Moreover, although not shown in drawing, when TFT for EL drive is made into multi-gate structure, degradation of TFT for EL drive by heat can be suppressed.

[0328] Next, another example of the circuit diagram of the pixel of the invention in this application is shown in drawing 19 (B). In drawing 19 (B), a pixel 1300 and a pixel 1310 adjoin and are prepared. In drawing 19 (B), 1301 and 1311 are TFT for switching. In addition, in the invention in this application, TFT 1301 and 1311 for switching can use n channel type TFT, p-channel type TFT, or either. N channel type TFT is used for TFT 1301 and 1311 for switching in drawing 19 (B). The gate electrode of TFT 1301 and 1311 for switching is connected to the gate signal lines 1302 and 1312 which input a gate signal, respectively. The source field and drain field of TFT 1301 and 1311 for switching are connected to the data signal line (it is also called a source signal line) 1303 into which one side inputs an analog or a digital video signal, respectively. Moreover, another side is connected to the gate electrode of TFT 1304 and 1314 for EL drive, respectively.

[0329] And one side is connected to the current supply line 1320 for the source field and drain field of TFT 1304 and 1314 for EL drive, and another side is connected to EL elements 1305 and 1315, respectively. Thus, at this example, two adjacent pixels are sharing one current supply line 1320. Thereby, the number of current supply lines can be reduced compared with the composition shown by drawing 17 and drawing 18 . If the rate over the whole pixel section of wiring is small, when wiring is formed in the direction in which EL layer emits light, cover of the light by wiring is suppressed. And in the circuit diagram shown in drawing 20 (B), the current supply line 1320 is located in a line in parallel with the gate signal lines 1302 and 1312.

[0330] EL elements 1305 and 1315 become in EL layer prepared between an anode plate, cathode, and an anode plate and cathode, respectively. In addition, in the invention in this application, when an anode plate is [cathode] a counterelectrode in a pixel electrode, the source field or drain field of TFT 1304 and 1314 for EL drive is connected to the anode plate of EL elements 1305 and 1315. Conversely, by the counterelectrode, as for the source field or drain field of TFT 1304 and 1314 for EL drive, cathode is connected to the cathode of EL elements 1305 and 1315 for it, when an anode plate is a pixel electrode. In addition, although the objects 1304 and 1314 for EL drive can use n channel type TFT, p-channel type TFT, or either, when the anode plate of EL elements 1305 and 1315 is [cathode] a counterelectrode in a pixel

electrode, it is desirable [TFT 1304 and 1314 for EL drive] that it is p-channel type TFT. Moreover, when the anode plate of EL elements 1305 and 1315 is [cathode] a pixel electrode in a counterelectrode conversely, as for TFT 1304 and 1314 for EL drive, it is desirable that it is n channel type TFT. In drawing 19 (B), p-channel type TFT is used for TFT 1304 and 1314 for EL drive, and the cathode of EL elements 1305 and 1315 is connected to the regular power supplies 1306 and 1316.

[0331] Moreover, a LDD field may be prepared into the barrier layer of TFT 1304 and 1314 for EL drive, and the field (Lov field) with which a LDD field and a gate electrode lap through a gate insulator layer may be formed. When especially TFT 1304 and 1314 for EL drive is n channel type TFT, the ON state current can be made to increase by forming a Lov field in the drain field side of a barrier layer, and capacity can be formed between the gate electrode of TFT 1304 and 1314 for EL drive, and a Lov field.

[0332] Moreover, when TFT 1301 and 1311 for switching is in the state (state of OFF) where it does not choose, in order to hold the gate voltage of TFT 1304 and 1314 for EL drive, you may form a capacitor. When forming a capacitor, a capacitor is connected between the current supply lines 1320 the direction which is not connected to the source signal line of the source field of TFT 1301 and 1311 for switching, and a drain field.

[0333] In addition, in the circuit diagram shown in drawing 19 (B), it is good also considering TFT 1301 and 1311 for switching, or TFT 1304 and 1314 for EL drive as multi-gate structure. The circuit diagram of the pixel which made TFT 1301 and 1311 for switching of the pixel shown in drawing 19 (B) multi-gate structure is shown in drawing 20 (B).

[0334] TFT1301a for switching and TFT1301b for switching connect in series, and are prepared. Moreover, TFT1311a for switching and TFT1311b for switching connect in series, and are prepared. The circuit diagram and composition which were shown in drawing 19 (B) are the same except TFT 1301a and 1301b for switching, TFT1311a for switching, and 1311b. The OFF state current can be lowered by making TFT for switching into multi-gate structure. In addition, although considered as double-gate structure in drawing 20 (B), this example is not limited to DABURUGETO and should just be multi-gate structure.

[0335] Moreover, although not shown in drawing, when TFT for EL drive is made into multi-gate structure, degradation of TFT for EL drive by heat can be suppressed.

[0336] In addition, in this example, you may prepare a resistor between the drain field of TFT for EL drive, and the pixel electrode which an EL element has. By preparing a resistor, the amount of current supplied to an EL element from TFT for EL drive is

controlled, and it becomes possible to prevent the influence of the variation in the property of TFT for EL drive. If a resistor is an element which shows resistance larger enough than the on resistance of TFT for EL drive, since it is good, there will be no limitation in structure etc. In addition, an on resistance is the value which broke the drain voltage of TFT by the drain current which is flowing then, when TFT is in the state of ON. What is necessary is just to choose from the range of 1kohm-50M omega (preferably 10 k ohm - 10 M omega, still more preferably 50 k ohm - 1 M omega) as resistance of a resistor. When a semiconductor layer with resistance high as a resistor is used, formation is easy and desirable.

[0337] It combines with examples 1, 3, 4, 5, or 6 freely, and composition shown in this example can be carried out.

[0338] (Example 8) The invention in this application is not limited to organic EL material, but even if it uses inorganic EL material, it can be carried out. However, since driver voltage is very high, the present inorganic EL material must use TFT which has the proof-pressure property that such driver voltage can be borne.

[0339] Or if inorganic EL material with prospective still lower driver voltage is developed, applying to the invention in this application is possible.

[0340] Moreover, the composition of this example can combine which composition of examples 1-7 freely.

[0341] (Example 9) In the invention in this application, even if the organic substance used as an EL layer is a low-molecular system organic substance, it may be a polymer system (macromolecule system) organic substance. The material [organic substance / low-molecular system] consisting mainly of Alq3 (tris-8-KINORI light-aluminum), TPD (triphenylamine derivative), etc. is known. The matter of pi conjugate polymer system is mentioned as a polymer system organic substance. Typically, PPV (polyphenylene vinylene), PVK (polyvinyl carbazole), a polycarbonate, etc. are mentioned.

[0342] A polymer system (macromolecule system) organic substance can be formed by the simple thin film formation methods, such as the spin coating method (it is also called the solution applying method), a dipping method, the dispensing method, print processes, or the ink-jet method, and its thermal resistance is high compared with a low-molecular system organic substance.

[0343] moreover, EL layer which the EL element has in the EL element which the ElectroLuminescent Display of the invention in this application has -- an electronic transporting bed -- raw -- a hole -- the case where it has the transporting bed -- an electronic transporting bed -- raw -- a hole -- a transporting bed may consist of

amorphous semiconductors, such as an inorganic material, for example, amorphous Si, or amorphous Si1-xCx

[0344] A lot of interface level is formed in the interface to which a lot of trap levels exist in an amorphous semiconductor, and an amorphous semiconductor touches other layers. Therefore, an EL element can also attain high brightness-ization while being able to make it emit light on low voltage.

[0345] Moreover, a dopant (impurity) may be added in organic EL layer, and the color of luminescence of organic EL layer may be changed. As a dopant, DCM1, the Nile red, rubrene, a coumarin 6, TPB, a Quinacridone, etc. are mentioned.

[0346] Moreover, the composition of this example can combine which composition of examples 1-7 freely.

[0347] (Example 10) The another drive method of the ElectroLuminescent Display of the invention in this application shown in drawing 1 and drawing 2 below is explained. Here, the case where a n bit digital drive method performs the full color display of 2n gradation is explained. In addition, since the timing chart is the same as the case where the form of operation shows, drawing 3 is referred to.

[0348] Two or more pixels 104 are arranged by the shape of a matrix at the pixel section 101. The enlarged view of a pixel 104 is shown in drawing 2 (A). In drawing 2 (A), 105 is TFT for switching. The gate electrode of TFT105 for switching is connected to the gate signal line 106 which inputs a gate signal. The source field and drain field of TFT105 for switching are connected to the capacitor 113 which the gate electrode and each pixel of TFT108 for EL drive have [another side] in the source signal line 107 into which one side inputs a digital data signal, respectively.

[0349] Moreover, as for the source field and drain field of TFT108 for EL drive, one side is connected to the current supply line 111, and another side is connected to EL element 110. The current supply line 111 is connected to the capacitor 113. When TFT105 for switching is in the state (OFF state) where it does not choose, the capacitor 113 is formed in order to hold the gate voltage of TFT108 for EL drive.

[0350] EL element 110 consists of an EL layer prepared between an anode plate, cathode, and an anode plate and cathode. When the anode plate has connected with the source field of TFT110 for EL drive, or a drain field, it puts in another way and an anode plate is a pixel electrode, the cathode which is a counterelectrode is maintained at fixed potential. Conversely, when cathode has connected with the source field of TFT110 for EL drive, or a drain field, it puts in another way and cathode is a pixel electrode, the anode plate which is a counterelectrode is maintained at fixed potential.

[0351] The current supply line 111 is maintained at power supply potential.

[0352] In addition, you may prepare a resistor between the drain field of TFT108 for EL drive or a source field, and EL element 110. By preparing a resistor, the amount of current supplied to an EL element from TFT for EL drive is controlled, and it becomes possible to prevent the influence of the variation in the property of TFT for EL drive. If a resistor is an element which shows resistance larger enough than the on resistance of TFT108 for EL drive, since it is good, there will be no limitation in structure etc. In addition, an on resistance is the value which broke the drain voltage of TFT by the drain current which is flowing then, when TFT is an ON state. What is necessary is just to choose from the range of 1kohm-50M omega (preferably 10 k ohm - 10 M omega, still more preferably 50 k ohm - 1 M omega) as resistance of a resistor. When a semiconductor layer with resistance high as a resistor is used, formation is easy and desirable.

[0353] The structure of the pixel section of the ElectroLuminescent Display of the invention in this application is shown in drawing 2 (B). The gate signal line (G1-Gn) is connected to the gate electrode of TFT for switching which each pixel has. One side is connected to a source signal line (S1-Sn), and, as for the source field and drain field of TFT for switching which each pixel has, another side is connected to the gate electrode and capacitor of TFT for EL drive. Moreover, as for the source field and drain field of TFT for EL drive, one side is connected to the current supply line (V1-Vn) at the EL element which each pixel has [another side]. The capacitor by which each pixel has a current supply line (V1-Vn) is connected.

[0354] The timing chart in the ElectroLuminescent Display shown in drawing 2 (A) is shown in drawing 3 . First, an one-frame period (F) is divided during [n] the subframe (SF1-SFn). In addition, all the pixels of the pixel section call the period which displays one picture one-frame period. In the ElectroLuminescent Display of the invention in this application, 120 or more frame periods are prepared in 1 second, and 60 or more pictures are displayed in 1 second as a result.

[0355] When the number of the pictures displayed in 1 second becomes less than 120, a flicker of pictures, such as a flicker, begins to be visually conspicuous.

[0356] In addition, the period which divided the one-frame period into plurality further is called subframe period. The number of partitions of an one-frame period must also increase as the number of gradation increases, and you have to drive a drive circuit on high frequency.

[0357] One subframe period is divided into an address period (Ta) and a sustain period (Ts). An address period is time taken to input data into all pixels during the 1 subframe, and the sustain period (it is also called a lighting period) shows the period which

displays.

[0358] All the length of the address period (Ta1-Tan) which it has, respectively has n the same subframe periods (SF1-SFn). SF1-SFn set to Ts1-Tsn the sustain period (Ts) which it has, respectively, respectively.

[0359] The length of a sustain period is [-- It sets up so that it may become :2-(n-2):2- (n-1).] Ts1:Ts2:Ts3. : -- It is :Ts(n-1):Tsn=20:2-1:2-2. : However, you may carry out sequence of making SF1-SFn appearing, what. A desired gradation display can be performed among 2n gradation in the combination of this sustain period.

[0360] In the address period, the current supply line (V1-Vn) is first maintained at the power supply potential of the same height as regular potential. In this specification, it is called the power supply potential of OFF of the power supply potential in the address period of a digital drive. In addition, the height of the power supply potential of OFF is the range in which an EL element does not emit light, and if it is the same as the height of regular potential, it is good. In addition, it is called EL driver voltage of OFF of EL driver voltage at this time. Although it is ideally desirable that it is 0V as for EL driver voltage of OFF, what is necessary is just the size which is the grade to which an EL element does not emit light.

[0361] And a gate signal is inputted into the gate signal line G1, and all TFT for switching by which the gate electrode is connected to the gate signal line G1 will be in the state of ON.

[0362] In the state of ON of TFT for switching by which the gate electrode is connected to the gate signal line G1, a digital data signal is inputted into a source signal line (S1-Sn) in order. The digital data signal has the information on "0" or "1", and means the signal with which the digital data signal of "0" and "1" has the voltage of either Hi or Lo, respectively. And the digital data signal inputted into the source signal line (S1-Sn) is inputted into the gate electrode of TFT for EL drive through TFT for switching of the state of ON (ON). Moreover, a digital data signal is inputted also into a capacitor and it is held.

[0363] Next, a gate signal is inputted into the gate signal line G2, and all TFT for switching by which the gate electrode is connected to the gate signal line G2 will be in the state of ON. And where TFT for switching by which the gate electrode is connected to the gate signal line G2 is turned ON, a digital data signal is inputted into a source signal line (S1-Sn) in order. The digital data signal inputted into the source signal line (S1-Sn) is inputted into the gate electrode of TFT for EL drive through TFT for switching. Moreover, a digital data signal is inputted also into a capacitor and it is held.

[0364] Operation mentioned above is repeated and a digital data signal is inputted into all pixels. A period until a digital data signal is inputted into all pixels is an address period.

[0365] A sustain period comes at the same time an address period expires. If a sustain period comes, the potential of a current supply line (V1-Vn) will change to the power supply potential of ON from the power supply potential of OFF. In this specification, it is called the power supply potential of ON of the power supply potential in the sustain period of a digital drive. The power supply potential of ON should just have the potential difference between regular potentials in the grade to which an EL element emits light. In addition, it is called EL driver voltage of ON of this potential difference.

[0366] And TFT for switching is turned off and the digital data signal held in the capacitor is inputted into the gate electrode of TFT for EL drive.

[0367] In this example, when the digital data signal has the information on "0", TFT for EL drive will be in an OFF state, and the pixel electrode of an EL element is maintained at the power supply potential of OFF. Consequently, the EL element which the pixel to which the digital data signal which has the information on "0" was impressed has does not emit light.

[0368] On the contrary, when it has the information on "1", TFT for EL drive will be in an ON state, and the pixel electrode of an EL element becomes the power supply potential of ON. Consequently, the EL element which the pixel to which the digital data signal which has the information on "1" was impressed has emits light.

[0369] The period all whose TFT for switching is OFF states is a sustain period.

[0370] The periods which make an EL element emit light (a pixel is made to turn on) are one to Ts1-Tsn of periods. Here, it carries out to having made the pixel of Tsn predetermined during the period turn on.

[0371] Next, it enters during the address again, and if a data signal is inputted into all pixels, it will enter during the sustain. At this time, the period of either Ts1-Ts (n-1) turns into a sustain period. Here, it carries out to having made the pixel of Ts (n-1) predetermined during the period turn on.

[0372] The operation same about the n-2 remaining subframes is repeated hereafter, and they are Ts (n-2) and Ts (n-3) one by one. -- Ts1 and a sustain period are set up and it carries out to having made the pixel predetermined by each subframe turn on.

[0373] When n subframe periods appear, it means finishing an one-frame period. At this time, the gradation of the pixel is decided by integrating the length of the sustain period immediately after the sustain period which the pixel had turned on, and the address period when the digital data signal which in other words has the information

on "1" was impressed to the pixel. For example, when brightness when a pixel emits light in all sustain periods was made into 100% at the time of n= 8 and a pixel emits light in Ts1 and Ts2, 75% of brightness can be expressed, and when Ts3, and Ts5 and Ts8 are chosen, 16% of brightness can be expressed.

[0374] An end of an one-frame period changes the height of the power supply potential of ON so that the polarity of EL driver voltage of the ON which is the difference of regular potential and the power supply potential of ON may become reverse in the next frame period. and a previous frame period -- the same -- operation mentioned above is performed However, since EL driver voltage of the ON in this frame period has the reverse polarity of EL driver voltage of the ON in a previous frame period, no EL elements emit light. In this specification, the frame period when an EL element displays a picture is called display frame period. Moreover, the frame period which does not display a picture, without no EL elements emitting light conversely is called non-display frame period.

[0375] After a non-display frame period expires, display frame period another next comes and EL driver voltage of ON changes to the voltage which has the reverse polarity of EL driver voltage of the ON in a non-display frame period.

[0376] Thus, a picture is displayed by repeating a display frame period and a non-display frame period by turns. The invention in this application is having the above-mentioned composition, and requires reverse polar EL driver voltage for EL layer which an EL element has for every fixed period. Therefore, degradation of the current-voltage characteristic of an EL element is improved and it becomes possible to lengthen the life of an EL element compared with the conventional drive method.

[0377] Moreover, in an alternating current drive, as mentioned above, when displaying a picture for every one-frame period, a flicker will arise as a flicker to an observer's eyes.

[0378] Therefore, at the invention in this application, the alternating current drive of the ElectroLuminescent Display is carried out on the frequency of the double not less of the frequency which a flicker does not produce to an observer's eyes in a direct-current drive. That is, 120 or more frame periods are prepared in 1 second, and 60 or more pictures are displayed in 1 second as a result. The above-mentioned composition protects the flicker by alternating current drive.

[0379] It combines with examples 2-9 freely, and composition shown in this example can be carried out.

[0380] (Example 11) By this example, when performing a time-sharing gradation display by the alternating current drive of a digital method, example with an another

example 1 which changes EL driver voltage of ON for every subframe period at reverse polarity is explained. Here, the case where a n bit digital drive method performs the full color time-sharing gradation display of 2n gradation is explained. In addition, since the timing chart is the same as the case where an example 1 shows, drawing 5 is referred to.

[0381] The structure of the pixel section of the ElectroLuminescent Display in this example is the same as the structure shown in drawing 2 (B), and the gate signal line (G1-Gn) is connected to the gate electrode of TFT for switching which each pixel has. One side is connected to a source signal line (S1-Sn), and, as for the source field and drain field of TFT for switching which each pixel has, another side is connected to the gate electrode and capacitor of TFT for EL drive. Moreover, as for the source field and drain field of TFT for EL drive, one side is connected to the current supply line (V1-Vn) at the EL element which each pixel has [another side]. The capacitor by which each pixel has a current supply line (V1-Vn) is connected.

[0382] The timing chart of the drive method of this example is shown in drawing 5 . First, an one-frame period is divided during [n] the subframe (SF1-SFn). In addition, all the pixels of the pixel section call the period which displays one picture one-frame period.

[0383] One subframe period is divided into an address period (Ta) and a sustain period (Ts). An address period is time taken to input data into all pixels during the 1 subframe, and the sustain period (it is also called a lighting period) shows the period which makes an EL element emit light.

[0384] All the length of the address period (Ta1-Tan) which it has, respectively has n the same subframe periods (SF1-SFn). SF1-SFn set to Ts1-Tsn the sustain period (Ts) which it has, respectively, respectively.

[0385] The length of a sustain period is [-- It sets up so that it may become :2-(n-2):2- (n-1).] Ts1:Ts2:Ts3. : -- It is :Ts(n-1):Tsn=20:2-1:2-2. : However, you may carry out sequence of making SF1-SFn appearing, what. A desired gradation display can be performed among 2n gradation in the combination of this sustain period.

[0386] First, a current supply line (V1-Vn) is maintained at the power supply potential of OFF. And a gate signal is inputted into the gate signal line G1, and all TFT for switching by which the gate electrode is connected to the gate signal line G1 will be in the state of ON.

[0387] And in the state of ON of TFT for switching by which the gate electrode is connected to the gate signal line G1, a digital data signal is inputted into a source signal line (S1-Sn) in order. And the digital data signal inputted into the source signal

line (S1-Sn) is inputted into the gate electrode of TFT for EL drive through TFT for switching of the state of ON (ON). Moreover, a digital data signal is inputted also into a capacitor and it is held.

[0388] Operation mentioned above is repeated and a digital data signal is inputted into all pixels. A period until a digital data signal is inputted into all pixels is an address period.

[0389] A sustain period comes at the same time an address period expires. If a sustain period comes, the potential of a current supply line (V1-Vn) will change to the power supply potential of ON from the power supply potential of OFF. And TFT for switching is turned off and the digital data signal held in the capacitor is inputted into the gate electrode of TFT for EL drive.

[0390] In this example, the polarity of EL driver voltage of the ON which is the difference of the power supply potential of ON and a stationary potential becomes reverse for every subframe period by changing the height of power supply potential. Therefore, by making reverse polarity of EL driver voltage of ON in every subframe period, an ElectroLuminescent Display repeats a display and un-displaying. The subframe period which displays is called display subframe period, and the subframe period which does not display is called non-display subframe period.

[0391] For example, in the 1st frame period, supposing the 1st subframe period is a display period, the 2nd subframe period will be a non-display period, and the 3rd frame period will turn into a display period again. And if all subframe periods appear and the 1st frame period expires, the 2nd frame period will come. In the 1st subframe period in the 2nd frame period, since EL driver voltage which has polarity contrary to EL driver voltage applied to the EL element in the 1st subframe period within the 1st frame period is applied to EL layer of an EL element, it serves as a non-display period. And next, the 2nd subframe period turns into a display period, and turns into a display period and a non-display period by turns for every subframe period.

[0392] In addition, in this specification, the polarity of EL driver voltage calls the period when displaying display period, when a display and un-displaying change by the bird clapper conversely. Moreover, the period when not displaying conversely is called non-display period. Therefore, in this specification, a display frame period and a display subframe period are named generically, and it is called a display period. Moreover, a non-display frame period and a non-display subframe period are conversely named generically, and it is called a non-display period.

[0393] When the digital data signal has the information on "0" in this example, TFT for EL drive will be in an OFF state, and the pixel electrode of an EL element is

maintained at the power supply potential of OFF. Consequently, the EL element which the pixel to which the digital data signal which has the information on "0" was added has does not emit light.

[0394] On the contrary, when it has the information on "1", TFT for EL drive will be in an ON state, and the pixel electrode of an EL element becomes the power supply potential of ON. Consequently, the EL element which the pixel as which the digital data signal which has the information on "1" was inputted has emits light.

[0395] The period all whose TFT for switching is OFF states is a sustain period.

[0396] The periods which make an EL element emit light (a pixel is made to turn on) are one to Ts1-Tsn of periods. Here, it carries out to having made the pixel of Tsn predetermined during the period turn on.

[0397] Next, it enters during the address again, and if a data signal is inputted into all pixels, it will enter during the sustain. At this time, the period of either Ts1-Ts (n-1) turns into a sustain period. Here, it carries out to having made the pixel of Ts (n-1) predetermined during the period turn on.

[0398] The operation same about the n-2 remaining subframes is repeated hereafter, and they are Ts (n-2) and Ts (n-3) one by one. -- Ts1 and a sustain period are set up and it carries out to having made the pixel predetermined by each subframe turn on.

[0399] Thus, in the time-sharing gradation display of an alternating current drive, when applying to an EL element EL driver voltage which has reverse polarity for every subframe, one gradation display is performed in two frame periods. In two adjacent frame periods, the gradation of the pixel is decided by integrating the length of the sustain period immediately after the sustain period which the pixel had turned on, and the address period when the digital data signal which in other words has the information on "1" was inputted into the pixel. For example, when brightness when a pixel emits light in all sustain periods was made into 100% at the time of n= 8 and a pixel emits light in Ts1 and Ts2, 75% of brightness can be expressed, and when Ts3, and Ts5 and Ts8 are chosen, 16% of brightness can be expressed.

[0400] The invention in this application is having the above-mentioned composition, and requires reverse polar EL driver voltage for EL layer which an EL element has for every subframe period. Therefore, degradation of the current-voltage characteristic of an EL element is improved and it becomes possible to lengthen the life of an EL element compared with the conventional drive method.

[0401] In this example, the effect that a flicker cannot happen easily compared with the ElectroLuminescent Display of the digital method which carries out an alternating current drive for every frame period shown with the gestalt of operation is acquired.

[0402] It combines with examples 2-9 freely, and composition shown in this example can be carried out.

[0403] (Example 12) Since the ElectroLuminescent Display (EL module) formed by carrying out the invention in this application is a spontaneous light type, it is excellent in the visibility in a bright place compared with the liquid crystal display. Therefore, the invention in this application can be carried out to the ElectroLuminescent Display (the display display incorporating EL module is pointed out) of a direct viewing type. As an ElectroLuminescent Display, a personal computer monitor, the monitor for TV broadcast reception, an advertising display monitor, etc. are mentioned.

[0404] Moreover, the invention in this application can be carried out to all the electronic equipment that includes a display display as parts also including an above-mentioned ElectroLuminescent Display.

[0405] As such electronic equipment, the picture reproducer (equipment equipped with the display which specifically reproduces record media, such as a compact disk (CD), a laser disc (registered trademark) (LD), or a digital videodisc (DVD), and can display the picture) equipped with EL display, a video camera, a digital camera, head installation type displays (head mount display etc.), car navigation, a personal computer, Personal Digital Assistants (a mobile computer, a cellular phone, or digital book), and the record medium etc. is mentioned. The example of these electronic equipment is shown in drawing 14 .

[0406] Drawing 14 (A) is a personal computer and contains a main part 2001, a case 2002, ElectroLuminescent Display 2003, and keyboard 2004 grade. ElectroLuminescent Display 2003 of the invention in this application can be used for the display of a personal computer.

[0407] Drawing 14 (B) is a video camera and contains a main part 2101, ElectroLuminescent Display 2102, the voice input section 2103, the operation switch 2104, a dc-battery 2105, and television section 2106 grade. ElectroLuminescent Display 2102 of the invention in this application can be used for the display of a video camera.

[0408] Drawing 14 (C) is some head installation type EL display (right one side), and contains a main part 2301, a signal cable 2302, the head fixed band 2303, the display monitor 2304, optical system 2305, and ElectroLuminescent Display 2306 grade. ElectroLuminescent Display 2306 of the invention in this application can be used for the display of EL display.

[0409] Drawing 14 (D) is the picture reproducer (specifically DVD regenerative apparatus) equipped with the record medium, and contains a main part 2401, record

media (CD, LD, or DVD) 2402, the operation switch 2403, ElectroLuminescent Display (a) 2404, and ElectroLuminescent Display (b)2405 grade. Although an ElectroLuminescent Display (a) mainly displays image information and an ElectroLuminescent Display (b) mainly displays alphabetic information, these ElectroLuminescent Displays (a) of the invention in this application and (b) can be used for the display of the picture reproducer equipped with the record medium. In addition, the invention in this application can be used for CD regenerative apparatus, a game machine machine, etc. as a picture reproducer equipped with the record medium.

[0410] Drawing 14 (E) is a carried type (mobile) computer, and contains a main part 2501, the camera section 2502, the television section 2503, the operation switch 2504, and ElectroLuminescent Display 2505 grade. ElectroLuminescent Display 2505 of the invention in this application can be used for the display of a carried type (mobile) computer.

[0411] Moreover, if the luminescence brightness of EL material will become high in the future, it will also become possible to use for the projector of a front type or a rear mold.

[0412] As mentioned above, the scope of the invention in this application is very wide, and applying to the electronic equipment of all fields is possible. Moreover, even if the electronic equipment of this example uses the composition which consists of combination like an example 1 - 11 throats, it is realizable.

[0413]

[Effect of the Invention]

[0414] By the above-mentioned composition, reverse polar EL driver voltage is built over an EL element for every fixed period. Therefore, degradation of the current-voltage characteristic of an EL element is improved and it becomes possible to lengthen the life of an EL element compared with the conventional drive method.

[0415] Moreover, in an alternating current drive, as mentioned above, when displaying a picture for every one-frame period, a flicker will arise as a flicker to an observer's eyes.

[0416] Therefore, in the invention in this application, it is desirable to carry out the alternating current drive of the ElectroLuminescent Display on the frequency of the double not less of the frequency which a flicker does not produce to an observer's eyes in a direct-current drive. That is, it is desirable to express a picture as the frequency of 120Hz or more. The above-mentioned composition protects the flicker by alternating current drive.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing showing the composition of the ElectroLuminescent Display of the invention in this application.
[Drawing 2] The circuit diagram of the pixel section of the invention in this application.
[Drawing 3] The timing chart of an alternating current drive of the digital method of the invention in this application.
[Drawing 4] The timing chart of an alternating current drive of the analog method of the invention in this application.
[Drawing 5] The timing chart of an alternating current drive of the digital method of the invention in this application.
[Drawing 6] The circuit diagram and plan of the pixel section of the invention in this application. [of an ElectroLuminescent Display]
[Drawing 7] Drawing showing the cross-section structure of the ElectroLuminescent Display of the invention in this application.
[Drawing 8] Drawing showing the production process of an ElectroLuminescent Display.
[Drawing 9] Drawing showing the production process of an ElectroLuminescent Display.
[Drawing 10] Drawing showing the production process of an ElectroLuminescent Display.
[Drawing 11] Drawing showing the production process of an ElectroLuminescent

Display.

[Drawing 12] Drawing showing the appearance of EL module.

[Drawing 13] Drawing showing the appearance of EL module.

[Drawing 14] Drawing showing the example of electronic equipment.

[Drawing 15] The circuit diagram of the pixel section of the conventional ElectroLuminescent Display.

[Drawing 16] The timing chart of an alternating current drive of the conventional digital method.

[Drawing 17] The circuit diagram of the pixel section of the ElectroLuminescent Display of the invention in this application.

[Drawing 18] The circuit diagram of the pixel section of the ElectroLuminescent Display of the invention in this application.

[Drawing 19] The circuit diagram of the pixel section of the ElectroLuminescent Display of the invention in this application.

[Drawing 20] The circuit diagram of the pixel section of the ElectroLuminescent Display of the invention in this application.

[Drawing 21] Drawing showing the cross-section structure of the ElectroLuminescent Display of the invention in this application.

[Description of Notations]

101 Pixel Section

102 Source Signal Side Drive Circuit

103 Gate Signal Side Drive Circuit

104 Pixel

105 TFT for Switching

106 Gate Signal Line

107 Source Signal Line

108 TFT for EL Drive

110 EL Element

111 Current Supply Line

112 Regular Power Supply

113 Capacitor

114 Time-Sharing Gradation Data Signal Generating Circuit

[Translation done.]

CLAIMS

[Claim(s)]
[Claim 1] Are the display which has two or more pixels containing two or more EL elements, and a gradation display is performed because the aforementioned display controls time for two or more aforementioned EL elements in an one-frame period to emit light. The polarity of EL driver voltage which two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and is the difference of the potential of the 1st electrode of the above and the potential of the 2nd electrode of the above is display conversely characterized by the bird clapper for every one-frame period.
[Claim 2] It is the display which has two or more pixels containing two or more EL elements. the aforementioned display A gradation display is performed by controlling the sum of the length of the subframe period when two or more aforementioned EL elements emitted light among two or more subframe periods contained in an one-frame period. The polarity of EL driver voltage which two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and is the difference of the potential of the 1st electrode of the above and the potential of the 2nd electrode of the above is display conversely characterized by the bird clapper for every aforementioned subframe period.
[Claim 3] Two or more EL elements. Two or more pixels containing two or more TFT for EL drive which controls luminescence of two or more aforementioned EL elements, respectively, and two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. It is the display equipped with the above, and a gradation display is performed because the aforementioned display controls time for two or more aforementioned EL elements in an one-frame period to

emit light, two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and polarity of EL driver voltage which is the difference of the potential of the 1st electrode of the above and the potential of the 2nd electrode of the above is conversely characterized by the bird clapper for every one-frame period.
[Claim 4] Two or more EL elements. Two or more pixels containing two or more TFT for EL drive which controls luminescence of two or more aforementioned EL elements, respectively, and two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. It is the display equipped with the above. the aforementioned display A gradation display is performed by controlling the sum of the length of the subframe period when two or more aforementioned EL elements emitted light among two or more subframe periods contained in an one-frame period. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and polarity of EL driver voltage which is the difference of the potential of the 1st electrode of the above and the potential of the 2nd electrode of the above is conversely characterized by the bird clapper for every aforementioned subframe period.
[Claim 5] Are the display which has two or more pixels containing two or more EL elements, and a gradation display is performed because the aforementioned display controls time for two or more aforementioned EL elements in an one-frame period to emit light. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the polarity of EL driver voltage which is the difference of the potential of the 1st electrode of the above, and the potential of the 2nd electrode of the above Display characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above between the pixels which are reverse for every one-frame period, and adjoin each other among two or more aforementioned pixels.
[Claim 6] It is the display which has two or more pixels containing two or more EL elements. the aforementioned display A gradation display is performed by controlling the sum of the length of the subframe period when two or more aforementioned EL elements emitted light among two or more subframe periods contained in an one-frame period. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the polarity of EL driver voltage which is the difference of the potential of the 1st electrode of the above, and the potential of the 2nd electrode of the above Display characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above between the pixels which are reverse for every aforementioned subframe period, and adjoin each

other among two or more aforementioned pixels.

[Claim 7] Two or more EL elements. Two or more pixels containing two or more TFT for EL drive which controls luminescence of two or more aforementioned EL elements, respectively, and two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. Are the display equipped with the above and a gradation display is performed because the aforementioned display controls time for two or more aforementioned EL elements in an one-frame period to emit light. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the polarity of EL driver voltage which is the difference of the potential of the 1st electrode of the above, and the potential of the 2nd electrode of the above It is reverse for every one-frame period, and is characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above between the pixels which adjoin each other among two or more aforementioned pixels.

[Claim 8] Two or more EL elements. Two or more pixels containing two or more TFT for EL drive which controls luminescence of two or more aforementioned EL elements, respectively, and two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. It is the display equipped with the above. the aforementioned display A gradation display is performed by controlling the sum of the length of the subframe period when two or more aforementioned EL elements emitted light among two or more subframe periods contained in an one-frame period. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the polarity of EL driver voltage which is the difference of the potential of the 1st electrode of the above, and the potential of the 2nd electrode of the above It is reverse for every aforementioned subframe period, and is characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above between the pixels which adjoin each other among two or more aforementioned pixels.

[Claim 9] It is the display characterized by the aforementioned TFT for EL drive and the aforementioned TFT for switching being n channel type TFT or p-channel type TFT in any 1 term of a claim 3, a claim 4, a claim 7, or a claim 8.

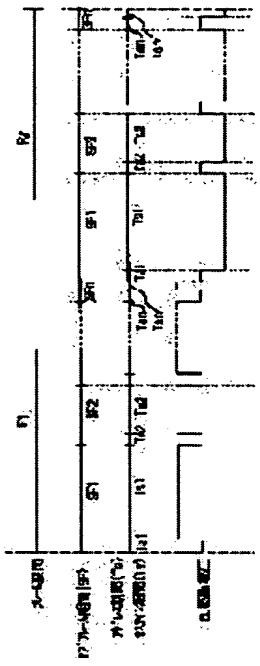
[Claim 10] It is the display characterized by being controlled by the digital data signal by which luminescence of two or more aforementioned EL elements is inputted into TFT for switching in any 1 term of a claim 1 or a claim 9.

[Claim 11] Display characterized by the aforementioned one-frame period being 1/120 or less s in any 1 term of a claim 1 or a claim 10.

[Claim 12] Two or more EL elements. Two or more pixels containing two or more TFT for EL drive which controls luminescence of two or more aforementioned EL elements, respectively, and two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. It is the display equipped with the above, and a gradation display is performed in the aforementioned display inputting the video signal of an analog into the source field of TFT for switching, two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and polarity of EL driver voltage which is the difference of the potential of the 1st electrode of the above and the potential of the 2nd electrode of the above is conversely characterized by the bird clapper for every one-frame period.
[Claim 13] Two or more EL elements. Two or more pixels containing two or more TFT for EL drive which controls luminescence of two or more aforementioned EL elements, respectively, and two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. It is the display equipped with the above. the aforementioned display A gradation display is performed in inputting the video signal of an analog into the source field of TFT for switching, and two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively. The potential of the 1st electrode of the above, The polarity of EL driver voltage which is the difference of the potential of the 2nd electrode of the above is reverse for every one-frame period, is the pixels which adjoin each other among two or more aforementioned pixels, and is characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above.
[Claim 14] It is the display characterized by the aforementioned TFT for EL drive and the aforementioned TFT for switching being n channel type TFT or p-channel type TFT in a claim 12 or a claim 13.
[Claim 15] Display characterized by the aforementioned one-frame period being 1/120 or less s in any 1 term of a claim 12 or a claim 14.
[Claim 16] EL layer which two or more aforementioned EL elements have in any 1 term of a claim 12 or a claim 15 is display characterized by being a low-molecular system organic substance or a polymer system organic substance.
[Claim 17] It is the display with which the aforementioned low-molecular system organic substance is characterized by the bird clapper in a claim 16 from Alq3 (tris-8-KINORI light-aluminum) or TPD (triphenylamine derivative).
[Claim 18] It is the display with which the aforementioned polymer system organic substance is characterized by the bird clapper from PPV (polyphenylene vinylene), PVK (polyvinyl carbazole), or a polycarbonate in a claim 16.

[Claim 19] The computer characterized by using the aforementioned display according to claim 1 to 18.
[Claim 20] The video camera characterized by using the aforementioned display according to claim 1 to 18.
[Claim 21] The DVD player characterized by using the aforementioned display according to claim 1 to 18.

[Translation done.]



(57)Abstract:
PROBLEM TO BE SOLVED: To provide a display device that service life of EL elements can be extended.
SOLUTION: The display device has plural pixels each of which includes plural EL elements. The electrooptical device conducts gradation display by controlling the light emitting time of the plural EL elements for one frame period. Each of the plural EL elements has first and second electrodes. The first electrode is kept at a constant common potential. The potential of the second electrode is held to a potential having a reverse polarity based on the common potential for every frame period.

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(54) DISPLAY DEVICE

TECHNICAL FIELD

[The technical field to which invention belongs] The invention in this application relates to the ElectroLuminescent Display (display) which made EL (electroluminescence) element on the substrate and was formed. It is related with the ElectroLuminescent Display especially using the semiconductor device (element using the semiconductor thin film). Moreover, it is related with the electronic equipment which used the ElectroLuminescent Display for the display.

[Translation done.]

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3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] The invention in this application relates to the ElectroLuminescent Display (display) which made EL (electroluminescence) element on the substrate and was formed. It is related with the

ElectroLuminescent Display especially using the semiconductor device (element using the semiconductor thin film). Moreover, it is related with the electronic equipment which used the ElectroLuminescent Display for the display.

[0002]

[Description of the Prior Art] In recent years, on the substrate, the technology which forms TFT progresses sharply and application development to active-matrix type display is furthered. Since electric field effect mobility (it is also called mobility) is higher than TFT using the conventional amorphous silicon film, high-speed operation is possible for especially TFT using the polysilicon contest film. Therefore, it is possible to perform control of a pixel in the drive circuit besides a substrate conventionally in the drive circuit formed on the same substrate as a pixel.

[0003] Various advantages, such as reduction of a manufacturing cost, a miniaturization of display, elevation of the yield, and reduction of a throughput, are acquired because such active-matrix type display makes various circuits and elements on the same substrate.

[0004] And research of an active-matrix type ElectroLuminescent Display with the EL element is activating as a spontaneous light type element further. The ElectroLuminescent Display is also called the organic EL display (OELD:Organic EL Display) or organic light emitting diode (OLED:Organic Light Emitting Diode).

[0005] Unlike a liquid crystal display, an ElectroLuminescent Display is a spontaneous light type. Although the EL element has the structure where EL layer was pinched by inter-electrode [of a couple], EL layer usually has a laminated structure. Typically, the laminated structure "the electron hole transporting bed / luminous layer / electronic transporting bed" which Tang and others of Eastman Kodak Co. proposed is mentioned. This structure has very high luminous efficiency, and most ElectroLuminescent Displays to which research and development are advanced have adopted this structure now.

[0006] Moreover, otherwise, the structure which carries out a laminating to the order of a hole-injection layer / electron hole transporting bed / luminous layer / electronic transporting bed, or a hole-injection layer / electron hole transporting bed / luminous layer / electronic transporting bed / electron-injection layer on a pixel electrode is sufficient. You may dope fluorescence nature coloring matter etc. to a luminous layer.

[0007] All the layers prepared in inter-electrode [of a couple] in this specification are named generically, and it is called EL layer. Therefore, all of the hole-injection layer mentioned above, an electron hole transporting bed, a luminous layer, an electronic transporting bed, an electron-injection layer, etc. are contained in EL layer.

[0008] And predetermined voltage is applied to EL layer which becomes with the above-mentioned structure from the electrode of a couple, and thereby, in a luminous layer, the reunion of a carrier happens and light is emitted. In addition, if an EL element drives that an EL element emits light in this specification, it will be called. Moreover, in this specification, the light emitting device formed by the anode plate, EL layer, and cathode is called EL element.

[0009]

[Problem(s) to be Solved by the Invention]

[0010] When putting an ElectroLuminescent Display in practical use, the shortness of the life of the EL element by degradation of EL layer had become a problem. As a factor which influences the length of the life of EL layer, the conditions in the structure of the device which drives an ElectroLuminescent Display, the property of organic EL material which constitutes EL layer, the material of an electrode, and creation distance etc. are mentioned.

[0011] And the drive method of an ElectroLuminescent Display is observed recently as a factor which influences the length of the life of EL layer other than the factor mentioned above.

[0012] In order to make an EL element emit light, generally the method of applying the current of a direct current to two electrodes whose EL layers were pinched, an anode plate and cathode, has been used conventionally. The time-sharing gradation display of the conventional digital method is explained using drawing 16 . Here, the case where a n bit digital drive method performs the full color display of 2n gradation is explained.

[0013] The structure of the pixel section of an ElectroLuminescent Display is shown in drawing 15 . The gate signal line (G1-Gn) into which a gate signal is inputted is connected to the gate electrode of TFT1501 for switching which each pixel has. Moreover, as for the source field and drain field of TFT1501 for switching which each pixel has, one side is connected to the capacitor 1508 which the gate electrode and each pixel of TFT1504 for EL drive which each pixel has [another side] have in the digital data signal at the source signal line (it is also called a data signal line) (S1-Sn) to input, respectively.

[0014] the source field and drain field of TFT1504 for EL drive which each pixel has -- respectively -- on the other hand, another side is connected to the current supply line (V1-Vn) at EL element 1506 The potential of a current supply line (V1-Vn) is called power supply potential. Moreover, the current supply line (V1-Vn) is connected to the capacitor 1508 which each pixel has. In addition, a digital data signal means a digital video signal.

[0015] EL element 1506 consists of an EL layer prepared between an anode plate, cathode, and an anode plate and cathode. When the anode plate has connected with the source field of TFT1504 for EL drive, or a drain field, it puts in another way and an anode plate is a pixel electrode, the cathode which is a counterelectrode is maintained at fixed potential. Conversely, when cathode has connected with the source field of TFT1504 for EL drive, or a drain field, it puts in another way and cathode is a pixel electrode, the anode plate which is a counterelectrode is maintained at fixed potential.
[0016] Moreover, in this specification, the potential of a counterelectrode is called stationary potential. In addition, the power supply which gives a stationary potential to a counterelectrode is called regular power supply. As for the potential of an anode plate, it is desirable that it is higher than the potential concerning cathode. Therefore, a stationary potential changes a counterelectrode by the anode plate or cathode. For example, when a counterelectrode is an anode plate, as for a stationary potential, it is desirable to make it higher than power supply potential. Conversely, when a counterelectrode is cathode, as for a stationary potential, it is desirable to make it lower than power supply potential.
[0017] The potential difference of the stationary potential of a counterelectrode and the power supply potential of a pixel electrode is EL driver voltage, and this EL driver voltage is built over EL layer.
[0018] The timing chart in the direct-current drive of the digital method of the conventional ElectroLuminescent Display is shown in drawing 16 . First, an one-frame period is divided during [n] the subframe (SF1-SFn). In addition, all the pixels of the pixel section call the period which displays one picture one-frame period (F). In the usual ElectroLuminescent Display, 60 or more frame periods are prepared in 60Hz or more, i.e., 1 second, and, as for oscillation frequency, 60 or more pictures are displayed in 1 second. When the number of the pictures displayed in 1 second becomes less than 60, a flicker of pictures, such as a flicker, begins to be visually conspicuous. In addition, the period which divided the one-frame period into plurality further is called subframe period. The number of partitions of an one-frame period must also increase as the number of gradation increases, and you have to drive a drive circuit on high frequency.
[0019] One subframe period is divided into an address period (Ta) and a sustain period (Ts). An address period is time taken to input data into all pixels during the 1 subframe, and the sustain period (it is also called a lighting period) shows the period which makes an EL element emit light.
[0020] All the length of the address period (Ta1-Tan) which it has, respectively has n

the same subframe periods (SF1-SFn). SF1-SFn set to Ts1-Tsn the sustain period (Ts) which it has, respectively, respectively.

[0021] The length of a sustain period is [-- It sets up so that it may become :2-(n-2):2- (n-1).] Ts1:Ts2:Ts3. : -- It is :Ts(n-1):Tsn=20:2-1:2-2. : However, you may carry out sequence of making SF1-SFn appearing, what. A desired gradation display can be performed among 2n gradation in the combination of this sustain period.

[0022] In the address period, the current supply line (V1-Vn) is first maintained at the power supply potential of the same height as a stationary potential. In this specification, it is called the power supply potential of OFF of the power supply potential in the address period of a digital drive. In addition, the height of the power supply potential of OFF is the range in which EL element 1506 does not emit light, and if it is the same as the height of a stationary potential, it is good. In addition, it is called EL driver voltage of OFF of EL driver voltage at this time. Although it is ideally desirable that it is 0V as for EL driver voltage of OFF, what is necessary is just the size which is the grade to which EL element 1506 does not emit light.

[0023] And a gate signal is inputted into the gate signal line G1, and TFT1501 for switching by which the gate electrode is connected to the gate signal line G1 will be in the state of ON altogether.

[0024] And in the state of ON of TFT1501 for switching by which the gate electrode is connected to the gate signal line G1, a digital data signal is inputted into a source signal line (S1-Sn) in order. The digital data signal has the information on "0" or "1", and means the signal with which the digital data signal of "0" and "1" has the voltage of either Hi or Lo, respectively. And the digital data signal inputted into the source signal line (S1-Sn) is inputted into the gate electrode of TFT1504 for EL drive through TFT1501 for switching of the state of ON (ON). Moreover, a digital data signal is inputted also into a capacitor 1508, and it is held.

[0025] next, TFT1501 for switching by which a gate signal is inputted into the gate signal line G2, and the gate electrode is connected to the gate signal line G2 -- all will be in the state of ON And where TFT1501 for switching by which the gate electrode is connected to the gate signal line G2 is turned ON, a digital data signal is inputted into a source signal line (S1-Sn) in order. The digital data signal inputted into the source signal line (S1-Sn) is inputted into the gate electrode of TFT1504 for EL drive through TFT1501 for switching. Moreover, a digital data signal is inputted also into a capacitor 1508, and it is held.

[0026] Operation mentioned above is repeated and a digital data signal is inputted into all pixels. A period until a digital data signal is inputted into all pixels is an address

period.

[0027] An address period turns into a sustain period simultaneously with an end. If a sustain period comes, the potential of a current supply line (V1-Vn) will change to the power supply potential of ON from the power supply potential of OFF. In a digital drive, in this specification, it is called the power supply potential of ON of the power supply potential in a sustain period. The power supply potential of ON should just have the potential difference between stationary potentials in the grade to which an EL element emits light. In addition, it is called EL driver voltage of ON of this potential difference. In addition, the power supply potential of OFF and the power supply potential of ON are named generically, and it is called power supply potential. Moreover, EL driver voltage of ON and EL driver voltage of OFF are named generically, and it is called EL driver voltage.

[0028] In a sustain period, TFT1501 for switching will be in an OFF state. And the digital data signal held in the capacitor 1508 is inputted into the gate electrode of TFT1504 for EL drive.

[0029] When the digital data signal has the information on "0", TFT1504 for EL drive will be in an OFF state, and the pixel electrode of EL element 1506 is maintained at the power supply potential of OFF. Consequently, EL element 1506 which the pixel to which the digital data signal which has the information on "0" was impressed has does not emit light.

[0030] On the contrary, when it has the information on "1", TFT1504 for EL drive will be in an ON state, and the pixel electrode of EL element 1506 becomes the power supply potential of ON. Consequently, EL element 1506 which the pixel to which the digital data signal which has the information on "1" was impressed has emits light.

[0031] The period all whose TFT1501 for switching is OFF states is a sustain period.

[0032] An EL element emits light in one to Ts1-Tsn of periods. In the period of Tsn, it carries out to having made the predetermined EL element emit light (a predetermined pixel being turned on).

[0033] Next, a sustain period appears, after an address period's appearing again and inputting a digital data signal into all pixels. At this time, the sustain period of either Ts1-Ts (n-1) appears. Here, Ts (n-1) appears and it carries out to having made the predetermined pixel turn on in the period of Ts (n-1).

[0034] Hereafter, the same operation is repeated also in the n-2 remaining subframes, and they are Ts (n-2) and Ts (n-3) one by one. -- Ts1 and a sustain period appear and it carries out to having made the predetermined pixel turn on in each subframe.

[0035] When n subframe periods appear, it means finishing an one-frame period. At

this time, the gradation of the pixel is decided by integrating the length of the sustain period immediately after the sustain period which the pixel had turned on within the one-frame period, and the address period when the digital data signal which in other words has the information on "1" was impressed to the pixel. For example, when brightness when a pixel emits light in all sustain periods was made into 100% at the time of n= 8 and a pixel emits light in Ts1 and Ts2, 75% of brightness can be expressed, and when Ts3, and Ts5 and Ts8 are chosen, 16% of brightness can be expressed.

[0036] Thus, the direct-current drive of the ElectroLuminescent Display is carried out conventionally, and EL driver voltage applied to EL layer had the always same polarity.

[0037] However, it is found out by applying reverse polar EL driver voltage to an EL element for every fixed period that degradation of the current-voltage characteristic of an EL element is improved as introduced in "TSUTSUI T, JPN J Appl Phys Part 2 VOL.37, and NO.11B PAGE.L1406-L1408 1998."

[0038] However, the ElectroLuminescent Display using the drive method of the ElectroLuminescent Display using degradation of the current-voltage characteristic of an EL element being improved and the aforementioned drive method was not specifically proposed by applying reverse polar EL driver voltage to an EL element for every fixed period.

[0039] Then, in order to prolong the life of an EL element, it was anxious for production of the ElectroLuminescent Display using the proposal of the drive method (in this specification, it is hereafter called an alternating current drive) and the aforementioned drive method of the ElectroLuminescent Display which displays on an EL element by applying reverse polar EL driver voltage for every fixed period. It was anxious for production of the active-matrix type ElectroLuminescent Display which displays especially by alternating current drive.

[0040]

[Means for Solving the Problem] In the drive of an ElectroLuminescent Display, the invention in this application maintains at fixed potential (regular potential) the 1st electrode which an EL element has, and maintains the 2nd electrode at the potential (power supply potential) of a current supply line. And for every fixed period, regular potential is fixed and the height of power supply potential is changed so that the polarity of EL driver voltage which is the difference of regular potential and power supply potential may become reverse. For example, supposing VT and power supply potential are [VD and EL driver voltage] VT-VD=deltaV in a certain period for regular potential, VD' and EL driver voltage will be set [regular potential] to VT-VD'=-deltaV by VT and power supply potential in the next period.

[0041] In the time-sharing gradation display by the drive circuit of a digital method, the polarity of EL driver voltage may be conversely changed for every one-frame period, and the polarity of EL driver voltage may be conversely changed for every 1 subframe period.

[0042] In the case of the drive circuit of an analog method, EL driver voltage is changed to reverse polarity for every one-frame period.

[0043] In addition, since an EL element is diode, when EL driver voltage with a certain polarity is applied and an EL element emits light, EL driver voltage, in addition the ** EL element which have reverse polarity do not emit light.

[0044] By the above-mentioned composition, reverse polar EL driver voltage is built over an EL element for every fixed period. Therefore, degradation of the current-voltage characteristic of an EL element is improved and it becomes possible to lengthen the life of an EL element compared with the conventional drive method.

[0045] Moreover, in an alternating current drive, as mentioned above, when displaying a picture for every one-frame period, a flicker will arise as a flicker to an observer's eyes.

[0046] Therefore, in the invention in this application, it is desirable to carry out the alternating current drive of the ElectroLuminescent Display on the frequency of the double not less of the frequency which a flicker does not produce to an observer's eyes in a direct-current drive. That is, it is desirable to prepare 120 or more frame periods and to display 60 or more pictures in 1 second. The above-mentioned composition protects the flicker by alternating current drive.

[0047] Moreover, the alternating current drive of the invention in this application is applicable not only to active-matrix type EL display but passive type EL display.

[0048] Below, the composition of the invention in this application is shown.

[0049] It is the display which has two or more pixels containing two or more EL elements by the invention in this application. A gradation display is performed because the aforementioned display controls time for two or more aforementioned EL elements in an one-frame period to emit light. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the potential of the 2nd electrode of the above The display characterized by changing so that the polarity of EL driver voltage which is the difference of the potential concerning the 1st electrode of the above and the potential concerning the 2nd electrode of the above may become reverse for every one-frame period is offered.

[0050] It is the display which has two or more pixels containing two or more EL

elements by the invention in this application. the aforementioned display A gradation display is performed by controlling the sum of the length of the subframe period when two or more aforementioned EL elements emitted light among two or more subframe periods contained in an one-frame period. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the potential of the 2nd electrode of the above The display characterized by changing so that the polarity of EL driver voltage which is the difference of the potential concerning the 1st electrode of the above and the potential concerning the 2nd electrode of the above may become reverse for every aforementioned subframe period is offered.

[0051] Two or more TFT for EL drive which controls luminescence of two or more EL elements and two or more aforementioned EL elements by the invention in this application, respectively, Two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively, Are the display which has the pixel of ****** plurality and a gradation display is performed because the aforementioned display controls time for two or more aforementioned EL elements in an one-frame period to emit light. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the potential of the 2nd electrode of the above The display characterized by changing so that the polarity of EL driver voltage which is the difference of the potential concerning the 1st electrode of the above and the potential concerning the 2nd electrode of the above may become reverse for every one-frame period is offered.

[0052] Two or more TFT for EL drive which controls luminescence of two or more EL elements and two or more aforementioned EL elements by the invention in this application, respectively, It is the display which has two or more pixels containing two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. the aforementioned display A gradation display is performed by controlling the sum of the length of the subframe period when two or more aforementioned EL elements emitted light among two or more subframe periods contained in an one-frame period. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the potential of the 2nd electrode of the above The display characterized by changing so that the polarity of EL driver voltage which is the difference of the potential concerning the 1st electrode of the above and the potential concerning the 2nd electrode of the above may become reverse for every

aforementioned frame period is offered.

[0053] It is the display which has two or more pixels containing two or more EL elements by the invention in this application. A gradation display is performed because the aforementioned display controls time for two or more aforementioned EL elements in an one-frame period to emit light. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the potential of the 2nd electrode of the above By the pixels which are changing so that the polarity of EL driver voltage which is the difference of the potential concerning the 1st electrode of the above and the potential concerning the 2nd electrode of the above may become reverse for every one-frame period, and adjoin each other among two or more aforementioned pixels The display characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above is offered.

[0054] It is the display which has two or more pixels containing two or more EL elements by the invention in this application. the aforementioned display A gradation display is performed by controlling the sum of the length of the subframe period when two or more aforementioned EL elements emitted light among two or more subframe periods contained in an one-frame period. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the potential of the 2nd electrode of the above By the pixels which are changing so that the polarity of EL driver voltage which is the difference of the potential concerning the 1st electrode of the above and the potential concerning the 2nd electrode of the above may become reverse for every aforementioned frame period, and adjoin each other among two or more aforementioned pixels The display characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above is offered.

[0055] Two or more TFT for EL drive which controls luminescence of two or more EL elements and two or more aforementioned EL elements by the invention in this application, respectively, Two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively, Are the display which has the pixel of ****** plurality and a gradation display is performed because the aforementioned display controls time for two or more aforementioned EL elements in an one-frame period to emit light. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the potential of the 2nd electrode of the above By the pixels which are changing so that the polarity of EL driver voltage which is the

difference of the potential concerning the 1st electrode of the above and the potential concerning the 2nd electrode of the above may become reverse for every one-frame period, and adjoin each other among two or more aforementioned pixels The display characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above is offered.

[0056] Two or more TFT for EL drive which controls luminescence of two or more EL elements and two or more aforementioned EL elements by the invention in this application, respectively, It is the display which has two or more pixels containing two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. the aforementioned display A gradation display is performed by controlling the sum of the length of the subframe period when two or more aforementioned EL elements emitted light among two or more subframe periods contained in an one-frame period. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the potential of the 2nd electrode of the above By the pixels which are changing so that the polarity of EL driver voltage which is the difference of the potential concerning the 1st electrode of the above and the potential concerning the 2nd electrode of the above may become reverse for every aforementioned subframe period, and adjoin each other among two or more aforementioned pixels The display characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above is offered.

[0057] The aforementioned TFT for EL drive and the aforementioned TFT for switching are n channel type TFT or p-channel type TFT.

[0058] Luminescence of two or more aforementioned EL elements may be controlled by the digital data signal inputted into TFT for switching.

[0059] The aforementioned one-frame period should just be 1/120 or less s.

[0060] Two or more TFT for EL drive which controls luminescence of two or more EL elements and two or more aforementioned EL elements by the invention in this application, respectively, It is the display which has two or more pixels containing two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. the aforementioned display A gradation display is performed in inputting the video signal of an analog into the source field of TFT for switching. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the 2nd electrode of the above The display characterized by being maintained at the voltage which has reverse polarity on the basis of the voltage built

over the 1st electrode for every one-frame period is offered.

[0061] Two or more TFT for EL drive which controls luminescence of two or more EL elements and two or more aforementioned EL elements by the invention in this application, respectively, It is the display which has two or more pixels containing two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. the aforementioned display A gradation display is performed in inputting the video signal of an analog into the source field of TFT for switching. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the 1st electrode of the above is maintained at fixed potential. the 2nd electrode of the above It is maintained at the voltage which has reverse polarity on the basis of the voltage built over the 1st electrode for every one-frame period, and the display characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above between the pixels which adjoin each other among two or more aforementioned pixels is offered.

[0062] The aforementioned TFT for EL drive and the aforementioned TFT for switching are n channel type TFT or p-channel type TFT.

[0063] The aforementioned one-frame period should just be 1/120 or less s.

[0064] EL layer which two or more aforementioned EL elements have may be a low-molecular system organic substance or a polymer system organic substance.

[0065] The aforementioned low-molecular system organic substance may consist of Alq3 (tris-8-kino rewrite-aluminum) or TPD (triphenylamine derivative).

[0066] The aforementioned polymer system organic substance may consist of PPV (polyphenylene vinylene), PVK (polyvinyl carbazole), or a polycarbonate.

[0067] The computer characterized by using the aforementioned display.

[0068] The video camera characterized by using the aforementioned display.

[0069] The DVD player characterized by using the aforementioned display.

[0070]

[Embodiments of the Invention]

[0071] The time-sharing gradation display of a digital drive method is explained using the example of an ElectroLuminescent Display which constitutes the invention in this application. An example of the circuitry of the invention in this application is shown in drawing 1 .

[0072] The ElectroLuminescent Display of drawing 1 has the source signal side drive circuit 102 arranged by TFT formed on the substrate around the pixel section 101 and the pixel section, and the gate signal side drive circuit 103. In addition, although the ElectroLuminescent Display has a source signal side drive circuit and every one gate

signal side drive circuit with the gestalt of this operation, in the invention in this application, there may be two source signal side drive circuits. Moreover, there may also be two gate signal side drive circuits.

[0073] The source signal side drive circuit 102 contains shift register 102a, (Latch A) 102b, and (Latch B) 102c fundamentally. Moreover, a clock signal (creatine kinase) and a start pulse (SP) are inputted into shift register 102a, a digital data signal (Digital Data Signals) is inputted into (Latch A) 102b, and a latch signal (Latch Signals) is inputted into (Latch B) 102c.

[0074] Moreover, although not illustrated, the gate signal side drive circuit 103 has a shift register and a buffer. You may prepare a multiplexer in the output side of a buffer.

[0075] The digital data signal inputted into the pixel section 101 is formed in the time-sharing gradation data signal generating circuit 114. In this circuit, while changing the video signal (signal containing image information) which becomes with an analog signal or a digital signal into the digital data signal for performing time-sharing gradation, it is the circuit which generates a timing pulse required in order to perform a time-sharing gradation display etc.

[0076] Typically in the time-sharing gradation data signal generating circuit 114 A means to divide an one-frame period during [two or more] the subframe corresponding to n bits (for n to be two or more integers) gradation, A means to choose an address period and a sustain period in the subframe period of these plurality, It is [-- A means to set up so that it may become :2-(n-2):2- (n-1) is included.] Ts1:Ts2:Ts3 about the length of the sustain period. : -- :Ts(n-1):Ts(n) =20:2-1:2-2 :

0077] This time-sharing gradation data signal generating circuit 114 may be established in the exterior of the ElectroLuminescent Display of the invention in this application. In this case, it becomes the composition that the digital data signal formed there is inputted into the ElectroLuminescent Display of the invention in this application. In this case, the electronic equipment (EL display) which has the ElectroLuminescent Display of the invention in this application as a display display will include the ElectroLuminescent Display of the invention in this application, and a time-sharing gradation data signal generating circuit as another parts.

[0078] Moreover, you may mount the time-sharing gradation data signal generating circuit 114 in the ElectroLuminescent Display of the invention in this application in forms, such as IC chip. In this case, it becomes the composition that the digital data signal formed with the IC chip is inputted into the ElectroLuminescent Display of the invention in this application. In this case, the electronic equipment which has the

ElectroLuminescent Display of the invention in this application as a display will contain as parts the ElectroLuminescent Display of the invention in this application which mounted IC chip including a time-sharing gradation data signal generating circuit.

[0079] Moreover, finally, on the same substrate as the pixel section 101, the source signal side drive circuit 102, and the gate signal side drive circuit 103, it has the time-sharing gradation data signal generating circuit 114 by TFT, and it can be formed. In this case, if the video signal which contains image information in an ElectroLuminescent Display is inputted, all can be processed on a substrate. The time-sharing gradation data signal generating circuit in this case may form a polysilicon contest film by TFT made into a barrier layer. Moreover, the time-sharing gradation data signal generating circuit is built in the ElectroLuminescent Display itself, and the electronic equipment which has the ElectroLuminescent Display of the invention in this application as a display in this case can attain the miniaturization of electronic equipment.

[0080] Two or more pixels 104 are arranged by the shape of a matrix at the pixel section 101. The enlarged view of a pixel 104 is shown in drawing 2 (A). In drawing 2 (A), 105 is TFT for switching. The gate electrode of TFT105 for switching is connected to the gate signal line 106 which inputs a gate signal. The source field and drain field of TFT105 for switching are connected to the capacitor 113 which the gate electrode and each pixel of TFT108 for EL drive have [another side] in the source signal line 107 into which one side inputs a digital data signal, respectively.

[0081] Moreover, as for the source field and drain field of TFT108 for EL drive, one side is connected to the current supply line 111, and another side is connected to EL element 110. The current supply line 111 is connected to the capacitor 113. When TFT105 for switching is in the state (OFF state) where it does not choose, the capacitor 113 is formed in order to hold the gate voltage of TFT108 for EL drive.

[0082] EL element 110 consists of an EL layer prepared between an anode plate, cathode, and an anode plate and cathode. Cathode is a counterelectrode, when the anode plate has connected with the source field of TFT110 for EL drive, or a drain field, it puts in another way and an anode plate is a pixel electrode. Conversely, an anode plate is a counterelectrode, when cathode has connected with the source field of TFT110 for EL drive, or a drain field, it puts in another way and cathode is a pixel electrode.

[0083] The current supply line 111 is maintained at power supply potential. It is [0084] maintained at potential with always fixed power supply potential in the gestalt of this operation. In addition, you may prepare a resistor between the drain field of TFT108 for EL drive or a source field, and EL element 110. By preparing a resistor, the amount of

current supplied to an EL element from TFT for EL drive is controlled, and it becomes possible to prevent the influence of the variation in the property of TFT for EL drive. If a resistor is an element which shows resistance larger enough than the on resistance of TFT108 for EL drive, since it is good, there will be no limitation in structure etc. In addition, an on resistance is the value which broke the drain voltage of TFT by the drain current which is flowing then, when TFT is an ON state. What is necessary is just to choose from the range of 1kohm-50M omega (preferably 10 k ohm - 10 M omega, still more preferably 50 k ohm - 1 M omega) as resistance of a resistor. When a semiconductor layer with resistance high as a resistor is used, formation is easy and desirable.

[0085] Next, the alternating current drive of the invention in this application is explained using drawing 2 (B) and drawing 3 . Here, the case where a n bit digital drive method performs the full color time-sharing gradation display of 2n gradation is explained.

[0086] The structure of the pixel section of the ElectroLuminescent Display of the invention in this application is shown in drawing 2 (B). The gate signal line (G1-Gn) is connected to the gate electrode of TFT for switching which each pixel has. One side is connected to a source signal line (S1-Sn), and, as for the source field and drain field of TFT for switching which each pixel has, another side is connected to the gate electrode and capacitor of TFT for EL drive. Moreover, as for the source field and drain field of TFT for EL drive, one side is connected to the current supply line (V1-Vn) at the EL element which each pixel has [another side]. The capacitor by which each pixel has a current supply line (V1-Vn) is connected.

[0087] The timing chart in the ElectroLuminescent Display shown in drawing 2 (A) is shown in drawing 3 . First, an one-frame period (F) is divided during [n] the subframe (SF1-SFn). In addition, all the pixels of the pixel section call the period which displays one picture one-frame period. In the ElectroLuminescent Display of the invention in this application, 120 or more frame periods are prepared in 1 second, and it is desirable that 60 or more pictures are displayed in 1 second as a result.

[0088] When the number of the pictures displayed in 1 second becomes less than 120, a flicker of pictures, such as a flicker, begins to be visually conspicuous.

[0089] In addition, the period which divided the one-frame period into plurality further is called subframe period. The number of partitions of an one-frame period must also increase as the number of gradation increases, and you have to drive a drive circuit on high frequency.

[0090] One subframe period is divided into an address period (Ta) and a sustain period

(Ts). An address period is time taken to input data into all pixels during the 1 subframe, and the sustain period (it is also called a lighting period) shows the period which displays.

[0091] All the length of the address period (Ta1-Tan) which it has, respectively has n the same subframe periods (SF1-SFn). SF1-SFn set to Ts1-Tsn the sustain period (Ts) which it has, respectively, respectively.

[0092] The length of a sustain period is [-- It sets up so that it may become :2-(n-2):2-(n-1).] Ts1:Ts2:Ts3. : -- It is :Ts(n-1):Tsn=20:2-1:2-2. : However, you may carry out sequence of making SF1-SFn appearing, what. A desired gradation display can be performed among 2n gradation in the combination of this sustain period.

[0093] In the address period, the counterelectrode is first maintained at the stationary potential of the same height as power supply potential. In this specification, it is called the stationary potential of OFF of the stationary potential in the address period of a digital drive. In addition, the height of the stationary potential of OFF is the range in which an EL element does not emit light, and if it is the same as the height of power supply potential, it is good. In addition, it is called EL driver voltage of OFF of EL driver voltage at this time. Although it is ideally desirable that it is 0V as for EL driver voltage of OFF, what is necessary is just the size which is the grade to which an EL element does not emit light.

[0094] And a gate signal is inputted into the gate signal line G1, and all TFT for switching by which the gate electrode is connected to the gate signal line G1 will be in the state of ON.

[0095] In the state of ON of TFT for switching by which the gate electrode is connected to the gate signal line G1, a digital data signal is simultaneously inputted into all source signal lines (S1-Sn). The digital data signal has the information on "0" or "1", and means the signal with which the digital data signal of "0" and "1" has the voltage of either Hi or Lo, respectively. And the digital data signal inputted into the source signal line (S1-Sn) is inputted into the gate electrode of TFT for EL drive through TFT for switching of the state of ON (ON). Moreover, a digital data signal is inputted also into a capacitor and it is held.

[0096] Next, a gate signal is inputted into the gate signal line G2, and all TFT for switching by which the gate electrode is connected to the gate signal line G2 will be in the state of ON. And where TFT for switching by which the gate electrode is connected to the gate signal line G2 is turned ON, a digital data signal is simultaneously inputted into all source signal lines (S1-Sn). The digital data signal inputted into the source signal line (S1-Sn) is inputted into the gate electrode of TFT for EL drive through TFT

for switching. Moreover, a digital data signal is inputted also into a capacitor and it is held.

[0097] Operation mentioned above is repeated and a digital data signal is inputted into all pixels. A period until a digital data signal is inputted into all pixels is an address period.

[0098] A sustain period comes at the same time an address period expires. If a sustain period comes, the potential of a counterelectrode will change to the stationary potential of ON from the stationary potential of OFF. In this specification, it is called the stationary potential of ON of the stationary potential in the sustain period of a digital drive. The stationary potential of ON should just have the potential difference between power supply potentials in the grade to which an EL element emits light. In addition, it is called EL driver voltage of ON of this potential difference.

[0099] And TFT for switching is turned off and the digital data signal held in the capacitor is inputted into the gate electrode of TFT for EL drive.

[0100] In the gestalt of this operation, when the digital data signal has the information on "0", TFT for EL drive will be in an OFF state, and the pixel electrode of an EL element is maintained at the stationary potential of OFF. Consequently, the EL element which the pixel to which the digital data signal which has the information on "0" was impressed has does not emit light.

[0101] On the contrary, when it has the information on "1", TFT for EL drive will be in an ON state, and power supply potential is given to the pixel electrode of an EL element. Consequently, the EL element which the pixel to which the digital data signal which has the information on "1" was impressed has emits light.

[0102] The period all whose TFT for switching is OFF states is a sustain period.

[0103] The periods which make an EL element emit light (a pixel is made to turn on) are one to Ts1-Tsn of periods. Here, it carries out to having made the pixel of Tsn predetermined during the period turn on.

[0104] Next, an address period appears again, and if a data signal is inputted into all pixels, a sustain period will appear. At this time, the sustain period of either Ts1-Ts (n-1) appears. Here, it carries out to having made the pixel of Ts (n-1) predetermined during the period turn on.

[0105] The operation same about the n-2 remaining subframes is repeated hereafter, and they are Ts (n-2) and Ts (n-3) one by one. -- Ts1 and a sustain period are set up and it carries out to having made the pixel predetermined by each subframe turn on.

[0106] When n subframe periods appear, it means finishing an one-frame period. At this time, the gradation of the pixel is decided by integrating the length of the sustain period

immediately after the sustain period which the pixel had turned on within the one-frame period, and the address period when the digital data signal which in other words has the information on "1" was impressed to the pixel. For example, when brightness when a pixel emits light in all sustain periods was made into 100% at the time of n= 8 and a pixel emits light in Ts1 and Ts2, 75% of brightness can be expressed, and when Ts3, and Ts5 and Ts8 are chosen, 16% of brightness can be expressed.

[0107] An end of an one-frame period changes the height of the stationary potential of ON so that the polarity of EL driver voltage of the ON which it is with the difference of power supply potential and the stationary potential of ON may become reverse in the next frame period. and a previous frame period -- the same -- operation mentioned above is performed However, since EL driver voltage of the ON in this frame period has the reverse polarity of EL driver voltage of the ON in a previous frame period, no EL elements emit light. In this specification, the frame period when an EL element displays a picture is called display frame period. Moreover, the frame period which does not display a picture, without no EL elements emitting light conversely is called non-display frame period.

[0108] After a non-display frame period expires, display frame period another next comes and EL driver voltage of ON changes to the voltage which has the reverse polarity of EL driver voltage of the ON in a non-display frame period.

[0109] Thus, a picture is displayed by repeating a display frame period and a non-display frame period by turns. The invention in this application is having the above-mentioned composition, and requires reverse polar EL driver voltage for EL layer which an EL element has for every fixed period. Therefore, degradation of the current-voltage characteristic of an EL element is improved and it becomes possible to lengthen the life of an EL element compared with the conventional drive method.

[0110] Moreover, in an alternating current drive, as mentioned above, when displaying a picture for every one-frame period, a flicker will arise as a flicker to an observer's eyes.

[0111] Therefore, at the invention in this application, the alternating current drive of the ElectroLuminescent Display is carried out on the frequency of the double not less of the frequency which a flicker does not produce to an observer's eyes in a direct-current drive. That is, 120 or more frame periods are prepared in 1 second, and 60 or more pictures are displayed in 1 second as a result. The above-mentioned composition protects the flicker by alternating current drive.

[0112] In addition, in the drive method of an ElectroLuminescent Display shown with the gestalt of this operation, by always keeping power supply potential constant and changing opposite potential in an address period and a sustain period, the size of EL

driver voltage was changed and luminescence of an EL element was controlled. However, the invention in this application is not limited to this composition. The ElectroLuminescent Display of the invention in this application may always keep opposite potential constant, and may change the potential of a pixel electrode. That is, you may control luminescence of an EL element by always keeping the potential of a counterelectrode constant, changing power supply potential in an address period and a sustain period contrary to the case of the gestalt of operation, and changing the size of EL driver voltage.

[0113] Moreover, with the gestalt of this operation, since the potential and power supply potential of a counterelectrode were maintained at the same potential in the address period, the EL element did not emit light. However, the invention in this application is not limited to this composition. Also in an address period, you may be made to display by always establishing the potential difference which is the grade to which an EL element emits light between opposite potential and power supply potential like a display period. However, since the whole subframe period turns into a period which actually emits light in this case, it is [-- It sets up so that it may become :2-(n-2):2-(n-1).] SF1:SF2:SF3 about the length of a subframe period. : -- :SF(n-1):SFn=20:2-1:2-2 : By the above-mentioned composition, the picture of high brightness is acquired compared with the drive method of not making an address period emitting light.

[0114] Next, the drive method which carries out an alternating current drive by the analog method of the ElectroLuminescent Display of the invention in this application shown in drawing 1 and drawing 2 is explained. In addition, refer to drawing 4 for a timing chart.

[0115] The structure of the pixel section of the ElectroLuminescent Display which carries out an alternating current drive by the analog method is the same as the ElectroLuminescent Display which carries out an alternating current drive by the digital method, and the gate signal line (G1-Gn) is connected to the gate electrode of TFT for switching which each pixel has. One side is connected to a source signal line (S1-Sn), and, as for the source field and drain field of TFT for switching which each pixel has, another side is connected to the gate electrode and capacitor of TFT for EL drive. Moreover, as for the source field and drain field of TFT for EL drive, one side is connected to the current supply line (V1-Vn) at the EL element which each pixel has [another side]. The capacitor by which each pixel has a current supply line (V1-Vn) is connected.

[0116] The timing chart at the time of carrying out the alternating current drive of the ElectroLuminescent Display by the analog method is shown in drawing 4 . The period

when one gate signal line is chosen is called one-line period. Moreover, a period until selection of all gate signal lines is completed is equivalent to an one-frame period. Since there are n gate signal lines in the case of the gestalt of this operation, n line periods are prepared during one frame.

[0117] In addition, in the ElectroLuminescent Display of the invention in this application, it is desirable to prepare 120 or more frame periods in 1 second, and it is desirable to display 60 or more pictures in 1 second. When the number of the pictures displayed in 1 second becomes less than 60, a flicker of pictures, such as a flicker, begins to be visually conspicuous.

[0118] The number of the line periods in an one-frame period also increases as the number of gradation increases, and you have to stop having to drive a drive circuit on high frequency.

[0119] The supply voltage line (V1-Vn) is first maintained at the power supply potential of OFF. In addition, in the alternating current drive of an analog method, the height of the power supply potential of OFF is the range in which an EL element does not emit light, and if it is the same as the height of a stationary potential, it is good. In addition, it is called EL driver voltage of OFF of EL driver voltage at this time. Although it is ideally desirable that it is 0V as for EL driver voltage of OFF, what is necessary is just the size which is the grade to which EL element 1506 does not emit light.

[0120] In the 1st line period (L1), the video signal of an analog is inputted into a source signal line (S1-Sn) in order. The gate signal is inputted into the gate signal line G1 in the 1st line period (L1). Therefore, since TFT for switching (1 1) is turned on (ON), the video signal of the analog inputted into the source signal line S1 is inputted into the gate electrode of TFT for EL drive (1 1) through TFT for switching (1 1).

[0121] And the potential of the current supply line V1 changes from the power supply potential of OFF to saturation power supply potential. In addition, in this specification, saturation power supply potential is potential which has the potential difference between stationary potentials in the grade to which an EL element emits light in an analog drive.

[0122] The amount of the current which flows the channel formation field of TFT for EL drive is controlled by the size of the voltage of the video signal of the analog inputted into the gate electrode. When in an analog drive the video signal of an analog is inputted into the gate electrode of TFT for EL drive and a source field or a drain field is maintained at saturation power supply potential, it considers as the power supply potential of ON of another potential. In addition, it is called EL driver voltage of ON of EL driver voltage at this time.

[0123] EL driver voltage of the ON by which the size was controlled by the video signal of the analog impressed to the gate electrode of TFT for EL drive (1 1) is applied to an EL element.

[0124] Next, the video signal of an analog is similarly inputted into the source signal line S2, and TFT for switching (2 1) is turned on. Therefore, the video signal of the analog inputted into the source signal line S2 is inputted into the gate electrode of TFT for EL drive (2 1) through TFT for switching (2 1).

[0125] Therefore, TFT for EL drive (2 1) will be in an ON state. And the potential of the current supply line V2 changes from the power supply potential of OFF to saturation power supply potential. Therefore, EL driver voltage of the ON by which the size was controlled by the video signal of the analog impressed to the gate electrode of TFT for EL drive (2 1) is impressed to an EL element.

[0126] After the input of the video signal of the analog to a source signal line (S1-Sn) ends to a repeat operation mentioned above, the 1st line period (L1) expires. And next the 2nd line period (L2) comes, and a gate signal is inputted into the gate signal line G2. And the video signal of an analog is inputted into a source signal line (S1-Sn) in order like the 1st line period (L1).

[0127] The video signal of an analog is inputted into the source signal line S1. Since TFT for switching (1 2) is turned on [it], the video signal of the analog inputted into the source signal line S1 is inputted into the gate electrode of TFT for EL drive (1 2) through TFT for switching (1 2).

[0128] Therefore, TFT for EL drive (1 2) will be in an ON state. And the potential of the current supply line V1 changes from the power supply potential of OFF to saturation power supply potential. Therefore, EL driver voltage by which the size was controlled by the video signal of the analog impressed to the gate electrode of TFT for EL drive (1 2) is impressed to an EL element.

[0129] After the input of the video signal of the analog to a source signal line (S1-Sn) ends to a repeat operation mentioned above, the 2nd line period (L2) expires. And next the 3rd line period (L3) comes, and a gate signal is inputted into gate signal line G3. And a gate signal is inputted into a gate signal line (G1-Gn) in order, and an one-frame period expires.

[0130] After this frame period expires, when saturation power supply potential changes in the next frame period, the power supply potential of ON changes. And EL driver voltage of ON changes to the voltage which has reverse polarity. and a previous frame period -- the same -- operation mentioned above is performed However, EL driver voltage of the ON in this frame period has the reverse polarity of EL driver voltage of

the ON in a previous frame period. Therefore, EL driver voltage of the ON which has polarity contrary to a previous frame period is applied [no] to EL elements, and an EL element emits light. In this specification, the frame period which does not display a picture for the frame period when an EL element displays a picture, without [a display frame period and] no EL elements emitting light conversely is called non-display frame period.

[0131] After a non-display frame period expires, display frame period another next comes and EL driver voltage changes to the voltage which has the reverse polarity of EL driver voltage in a non-display frame period.

[0132] Thus, a picture is displayed by repeating a display frame period and a non-display frame period by turns. The invention in this application is having the above-mentioned composition, and requires EL driver voltage of reverse polar ON for an EL element for every fixed period. Therefore, degradation of the current-voltage characteristic of an EL element is improved and it becomes possible to lengthen the life of an EL element compared with the conventional drive method.

[0133] Moreover, although the gestalt of this operation explained the example driven by the non-interlaced scan, the invention in this application can also be driven by the interlace.

[0134]

[Example] Below, the example of the invention in this application is explained.

[0135] (Example 1) By this example, when performing a time-sharing gradation display by the alternating current drive of a digital method, the example which changes EL driver voltage of ON for every subframe period at reverse polarity is explained. Here, the case where a n bit digital drive method performs the full color time-sharing gradation display of 2n gradation is explained.

[0136] The structure of the pixel section of the ElectroLuminescent Display in this example is the same as the structure shown in drawing 2 (B), and the gate signal line (G1-Gn) is connected to the gate electrode of TFT for switching which each pixel has. One side is connected to a source signal line (S1-Sn), and, as for the source field and drain field of TFT for switching which each pixel has, another side is connected to the gate electrode and capacitor of TFT for EL drive. Moreover, as for the source field and drain field of TFT for EL drive, one side is connected to the current supply line (V1-Vn) at the EL element which each pixel has [another side]. The capacitor by which each pixel has a current supply line (V1-Vn) is connected.

[0137] The timing chart of the drive method of this example is shown in drawing 5 . First, an one-frame period is divided during [n] the subframe (SF1-SFn). In addition,

all the pixels of the pixel section call the period which displays one picture one-frame period.

[0138] In addition, the period which divided the one-frame period into plurality further is called subframe period. The number of partitions of an one-frame period must also increase as the number of gradation increases, and you have to drive a drive circuit on high frequency.

[0139] One subframe period is divided into an address period (Ta) and a sustain period (Ts). An address period is time taken to input data into all pixels during the 1 subframe, and the sustain period (it is also called a lighting period) shows the period which makes an EL element emit light.

[0140] All the length of the address period (Ta1-Tan) which it has, respectively has n the same subframe periods (SF1-SFn). SF1-SFn set to Ts1-Tsn the sustain period (Ts) which it has, respectively, respectively.

[0141] The length of a sustain period is [-- It sets up so that it may become :2-(n-2):2-(n-1).] Ts1:Ts2:Ts3. : -- It is :Ts(n-1):Tsn=20:2-1:2-2. : However, you may carry out sequence of making SF1-SFn appearing, what. A desired gradation display can be performed among 2n gradation in the combination of this sustain period.

[0142] First, a counterelectrode is maintained at the stationary potential of OFF. And a gate signal is inputted into the gate signal line G1, and all TFT for switching by which the gate electrode is connected to the gate signal line G1 will be in the state of ON.

[0143] And in the state of ON of TFT for switching by which the gate electrode is connected to the gate signal line G1, a digital data signal is simultaneously inputted into all source signal lines (S1-Sn). And the digital data signal inputted into the source signal line (S1-Sn) is inputted into the gate electrode of TFT for EL drive through TFT for switching of the state of ON (ON). Moreover, a digital data signal is inputted also into a capacitor and it is held.

[0144] Operation mentioned above is repeated and a digital data signal is inputted into all pixels. A period until a digital data signal is inputted into all pixels is an address period.

[0145] A sustain period comes at the same time an address period expires. If a sustain period comes, the potential of a counterelectrode will change to the stationary potential of ON from the stationary potential of OFF. And TFT for switching is turned off and the digital data signal held in the capacitor is inputted into the gate electrode of TFT for EL drive.

[0146] In this example, the polarity of EL driver voltage of the ON which is the difference of the stationary potential of ON and power supply potential becomes reverse

for every subframe period by changing the height of the stationary potential of ON. Therefore, by making reverse polarity of EL driver voltage of ON in every subframe period, an ElectroLuminescent Display repeats a display and un-displaying. The subframe period which displays is called display subframe period, and the subframe period which does not display is called non-display subframe period.

[0147] For example, in the 1st frame period, supposing the 1st subframe period is a display period, the 2nd subframe period will be a non-display period, and the 3rd frame period will turn into a display period again. And if all subframe periods appear and the 1st frame period expires, the 2nd frame period will come. In the 1st subframe period in the 2nd frame period, since EL driver voltage which has polarity contrary to EL driver voltage applied to the EL element in the 1st subframe period within the 1st frame period is applied to EL layer of an EL element, it serves as a non-display period. And next, the 2nd subframe period turns into a display period, and turns into a display period and a non-display period by turns for every subframe period.

[0148] In addition, in this specification, the polarity of EL driver voltage calls the period when displaying display period, when a display and un-displaying change by the bird clapper conversely. Moreover, the period when not displaying conversely is called non-display period. Therefore, in this specification, a display frame period and a display subframe period are named generically, and it is called a display period. Moreover, a non-display frame period and a non-display subframe period are conversely named generically, and it is called a non-display period.

[0149] When the digital data signal has the information on "0" in this example, TFT for EL drive will be in an OFF state, and the pixel electrode of an EL element is maintained at the stationary potential of OFF. Consequently, the EL element which the pixel to which the digital data signal which has the information on "0" was added has does not emit light.

[0150] On the contrary, when it has the information on "1", TFT for EL drive will be in an ON state, and power supply potential is given to the pixel electrode of an EL element. Consequently, the EL element which the pixel as which the digital data signal which has the information on "1" was inputted has emits light.

[0151] The period all whose TFT for switching is OFF states is a sustain period.

[0152] The periods which make an EL element emit light (a pixel is made to turn on) are one to Ts1-Tsn of periods. Here, it carries out to having made the pixel of Tsn predetermined during the period turn on.

[0153] Next, it enters during the address again, and if a digital data signal is inputted into all pixels, it will enter during the sustain. At this time, the period of either Ts1-Ts

(n-1) turns into a sustain period. Here, it carries out to having made the pixel of Ts (n-1) predetermined during the period turn on.

[0154] The operation same about the n-2 remaining subframes is repeated hereafter, and they are Ts (n-2) and Ts (n-3) one by one. -- Ts1 and a sustain period are set up and it carries out to having made the pixel predetermined by each subframe turn on.

[0155] Thus, in the time-sharing gradation display of an alternating current drive, when applying to an EL element EL driver voltage which has reverse polarity for every subframe, one gradation display is performed in two frame periods. In two adjacent frame periods, the gradation of the pixel is decided by integrating the length of the sustain period immediately after the sustain period which the pixel had turned on, and the address period when the digital data signal which in other words has the information on "1" was inputted into the pixel. For example, when brightness when a pixel emits light in all sustain periods was made into 100% at the time of n= 8 and a pixel emits light in Ts1 and Ts2, 75% of brightness can be expressed, and when Ts3, and Ts5 and Ts8 are chosen, 16% of brightness can be expressed.

[0156] The invention in this application is having the above-mentioned composition, and requires reverse polar EL driver voltage for EL layer which an EL element has for every subframe period. Therefore, degradation of the current-voltage characteristic of an EL element is improved and it becomes possible to lengthen the life of an EL element compared with the conventional drive method.

[0157] In this example, the effect that a flicker cannot happen easily compared with the ElectroLuminescent Display of the digital method which carries out an alternating current drive for every frame period shown with the gestalt of operation is acquired.

[0158] (Example 2) By this example, another example is indicated to be the pixel section of the ElectroLuminescent Display of the invention in this application shown by drawing 2 (A).

[0159] A circuit diagram shows an example of the enlarged view of the pixel section of the ElectroLuminescent Display of this example to drawing 6 (A). Two or more pixels are arranged by the shape of a matrix at the pixel section. A pixel 603 and a pixel 604 adjoin and are prepared. In drawing 6 (A), 605 and 625 are TFT for switching. The gate electrode of TFT 605 and 625 for switching is connected to the gate signal line 606 which inputs a gate signal. Another side is connected to the gate electrode and capacitors 613 and 623 of TFT for EL drive at the data signal lines (it is also called a source signal line) 607 and 627 into which, as for the source field and drain field of TFT 605 and 625 for switching, one side inputs a digital data signal, respectively.

[0160] And the source field of TFT 608 and 628 for EL drive is connected to the common

current supply line 611, and a drain field is connected to the pixel electrode which EL elements 610 and 630 have, respectively. Thus, at this example, two adjacent pixels are sharing the current supply line.

[0161] EL elements 610 and 630 become in EL layer prepared between an anode plate (this example pixel electrode), cathode (this example counterelectrode), and an anode plate and cathode, respectively. In this example, the drain field of TFT 608 and 628 for EL drive is connected to the anode plate. It connects with the regular power supplies 612 and 622, and cathode is maintained at the stationary potential. The invention in this application may not be limited to this composition, but the drain field of TFT 608 and 628 for EL drive may be connected to cathode.

[0162] In addition, you may prepare a resistor, respectively between the drain field of TFT 608 and 628 for EL drive, and the anode plate (pixel electrode) which EL elements 610 and 630 have, respectively. By preparing a resistor, the amount of current supplied to an EL element from TFT for EL drive is controlled, and it becomes possible to prevent the influence of the variation in the property of TFT for EL drive. If a resistor is an element which shows resistance larger enough than the on resistance of TFT 608 and 628 for EL drive, since it is good, there will be no limitation in structure etc. In addition, an on resistance is the value which broke the drain voltage of TFT by the drain current which is flowing then, when TFT is an ON state. What is necessary is just to choose from the range of 1kohm-50M omega (preferably 10 k ohm - 10 M omega, still more preferably 50 k ohm - 1 M omega) as resistance of a resistor. When a semiconductor layer with resistance high as a resistor is used, formation is easy and desirable.

[0163] Moreover, when TFT 605 and 625 for switching is in the state (OFF state) where it does not choose, in order to hold the gate voltage of TFT 608 and 628 for EL drive, capacitors 613 and 633 are formed. One side is connected to the drain field of TFT 605 and 625 for switching, and another side is connected to the current supply line 611 for two electrodes which these capacitors 613 and 633 have. In addition, it is not necessary to necessarily form capacitors 613 and 633.

[0164] The concrete block diagram of the circuit diagram shown in drawing 6 (B) by drawing 6 (A) is shown. The pixel 603 and the pixel 604 are formed in the field surrounded by the source signal lines 607 and 627, the gate signal lines 606 and 616, and the current supply line 611. As for the source field of TFT 608 and 628 for EL drive which a pixel 603 and a pixel 604 have, respectively, both are connected to the current supply line 611. Thus, at this example, two adjacent pixels are sharing the current supply line. Thereby, compared with the composition shown by drawing 2 (A), the rate of the wiring to the whole pixel section can be made small. If the rate over the whole pixel

section of wiring is small, when wiring is formed in the direction in which EL layer emits light, cover of the light by wiring is suppressed.

[0165] It combines with an example 1 freely and composition shown in this example can be carried out.

[0166] (Example 3)

[0167] this example explains the outline of the cross-section structure of the ElectroLuminescent Display of the invention in this application using drawing 7 .

[0168] In drawing 7 , it is the insulator layer (henceforth a ground film) from which 11 becomes a substrate and 12 becomes a ground. As a substrate 11, a glass substrate, a quartz substrate, a crystallized-glass substrate, or a glass-ceramics substrate can be used for a translucency substrate and a representation target. However, you have to bear the highest processing temperature in a production process.

[0169] Moreover, although especially the ground film 12 is effective when using the substrate containing a movable ion, and the substrate which has conductivity, you may not prepare in a quartz substrate. What is necessary is just to use the insulator layer containing silicon (silicon) as a ground film 12. in addition, in this specification, "the insulator layer containing silicon" points out the insulator layer in which predetermined came out of oxygen or nitrogen comparatively, and it was made to specifically contain to silicon, such as an oxidization silicon film, a silicon nitride film, or a nitriding oxidization silicon film (SiOxNy:x and y -- arbitrary integers -- come out and shown)

[0170] 201 is TFT for switching, 202 is TFT for EL drive, and it is formed by n channel type TFT and p-channel type TFT, respectively. When the luminescence direction of EL is the inferior surface of tongue (field in which TFT and EL layer are not prepared) of a substrate, it is desirable that it is the above-mentioned composition. However, the invention in this application is not limited to this composition. N channel type TFT, p-channel type TFT, or neither is available for TFT for switching, and TFT for EL drive.

[0171] TFT201 for switching has a barrier layer including the source field 13, the drain field 14, the LDD fields 15a-15d, an isolation region 16, and the channel formation fields 17a and 17b, the gate insulator layer 18, the gate electrodes 19a and 19b, the insulator layer 20 between the 1st layer, the source signal line 21, and the drain wiring 22. In addition, the gate insulator layer 18 or the insulator layer 20 between the 1st layer may be common to all TFT on a substrate, and may be changed according to a circuit or an element.

[0172] Moreover, the gate electrodes 19a and 19b are connected electrically, and TFT201 for switching shown in drawing 7 has the so-called double-gate structure. Of course, you may be the so-called multi-gate structures (structure containing the barrier layer which

has two or more channel formation fields connected in series), such as not only double-gate structure but triple gate structure.

[0173] Multi-gate structure is very effective when reducing the OFF state current, and if the OFF state current of TFT for switching is made low enough, a minimum capacity which the capacitor connected so much to the gate electrode of TFT202 for EL drive needs can be stopped. That is, since area of a capacitor can be made small, considering as multi-gate structure is effective when extending the effective luminescence area of an EL element.

[0174] Furthermore, in TFT201 for switching, the LDD fields 15a-15d are formed so that it may not lap with the gate electrodes 19a and 19b through the gate insulator layer 18. Such structure is very effective when reducing the OFF state current. Moreover, what is necessary is just to set typically 0.5-3.5 micrometers (width of face) of LDD fields [15a-15d] length to 2.0-2.5 micrometers.

[0175] In addition, it is still more desirable to prepare an offset field (field where it becomes in the semiconductor layer of the same composition as a channel formation field, and a gate voltage is not applied) between a channel formation field and a LDD field when lowering the OFF state current. Moreover, in the case of the multi-gate structure of having two or more gate electrodes, the isolation region 16 (field where the same impurity element was added by the same concentration as a source field or a drain field) prepared between channel formation fields is effective for reduction of the OFF state current.

[0176] Next, TFT202 for EL drive has a barrier layer including the source field 26, the drain field 27, and the channel formation field 29, the gate insulator layer 18, the gate electrode 30, the insulator layer 20 between the 1st layer, and the source signal line 31 and the drain wiring 32, and is formed. In this example, TFT202 for EL drive is p-channel type TFT.

[0177] Moreover, the drain field 14 of TFT201 for switching is connected to the gate 30 of TFT202 for EL drive. Although not illustrated, the gate electrode 30 of TFT202 for EL drive is specifically electrically connected through the drain field 14 of TFT201 for switching, and the drain wiring (it can also be called connection wiring) 22. In addition, although the gate electrode 30 has single-gate structure, you may be multi-gate structure. Moreover, the source signal line 31 of TFT202 for EL drive is connected to a current supply line (not shown).

[0178] TFT202 for EL drive is an element for controlling the amount of current poured into an EL element, and comparatively much current flows. Therefore, as for channel width (W), it is desirable to design more greatly than the channel width of TFT for

switching. Moreover, as for channel length (L), designing for a long time is desirable so that superfluous current may not flow to TFT202 for EL drive. It is made to be desirably set to 0.5-2microper pixel A (preferably 1-1.5microA).

[0179] Furthermore, you may suppress degradation of TFT by what thickness of the barrier layer (especially channel formation field) of TFT202 for EL drive is thickened for (preferably 50-100nm, still more preferably 60-80nm). On the contrary, in the case of TFT201 for switching, if the OFF state current is seen from a viewpoint of making it small, what thickness of a barrier layer (especially channel formation field) is made thin also for (preferably 20-50nm, still more preferably 25-40nm) is effective.

[0180] Although the above explained the structure of TFT established in the pixel, a drive circuit is also simultaneously formed at this time. The CMOS circuit used as the base unit which forms a drive circuit is illustrated by drawing 7 .

[0181] TFT which has the structure of reducing hot carrier pouring is used as n channel type TFT204 of a CMOS circuit, making it not reduce a working speed as much as possible in drawing 7 . In addition, as a drive circuit here, a source signal side drive circuit and a gate signal side drive circuit are pointed out. Of course, it is also possible to form other logical circuits (a level shifter, an A/D converter, signal dividing network, etc.).

[0182] In the LDD field 37, the barrier layer of n channel type TFT204 of a CMOS circuit has lapped with the gate electrode 39 through the gate insulator layer 18 including the source field 35, the drain field 36, the LDD field 37, and the channel formation field 38.

[0183] The consideration for not reducing a working speed forms the LDD field 37 only in the drain field 36 side. Moreover, it is better for this n channel type TFT204 to seldom have cared about the OFF state current value, and to attach greater importance than to it to a working speed. Therefore, as for the LDD field 37, it is desirable to keep in a gate electrode in piles completely, and to lessen a resistance component as much as possible. Namely, it is better to abolish the so-called offset.

[0184] Moreover, since degradation by hot carrier pouring hardly worries p-channel type TFT205 of a CMOS circuit, it does not need to prepare especially a LDD field. Therefore, as for a barrier layer, on it, the gate insulator layer 18 and the gate electrode 43 are formed including the source field 40, the drain field 41, and the channel formation field 42. Of course, it is also possible to prepare a LDD field like n channel type TFT204, and to take the cure against a hot carrier.

[0185] Moreover, n channel type TFT204 and p-channel type TFT205 have [on the source field] the source signal lines 44 and 45 through the insulator layer 20 in between

between the 1st layer, respectively. Moreover, the drain field of n channel type TFT204 and p-channel type TFT205 is mutually connected electrically by the drain wiring 46.

[0186] 47 [next,] -- the 1st passivation film -- it is -- thickness -- 10nm - 1 micrometer (preferably 200-500nm) -- then, it is good As a material, the insulator layer (a nitriding oxidization silicon film or a silicon nitride film is especially desirable) containing silicon can be used. This passivation film 47 has the role metal which protects formed TFT from alkali metal or moisture. Alkali metal, such as sodium, is contained in EL layer finally prepared above TFT (especially TFT for EL drive). That is, the 1st passivation film 47 works also as a protective layer which does not make such alkali metal (movable ion) invade into the TFT side.

[0187] Moreover, 48 is an insulator layer between the 2nd layer, and has the function as a flattening film to perform flattening of the level difference made by TFT. Between the 2nd layer, as an insulator layer 48, an organic resin film is desirable and it is good to use a polyimide, a polyamide, an acrylic, BCB (benz-cyclo-butene), etc. These organic resin films tend to form a good flat side, and specific inductive capacity has an advantage of a low. Since EL layer is very sensitive to irregularity, as for the level difference by TFT, it is desirable to absorb almost by the insulator layer 48 between the 2nd layer. Moreover, when reducing the parasitic capacitance formed between a gate signal line, a data signal line, and the cathode of an EL element, it is desirable to prepare the low material of specific inductive capacity thickly. Therefore, 0.5-5 micrometers (preferably 1.5-2.5 micrometers) of thickness are desirable.

[0188] Moreover, 49 is a pixel electrode (anode plate of an EL element) which becomes by the transparent electric conduction film, and after it reaches insulator layer 48 between the 2nd layer and opens a contact hole (puncturing) in the 1st passivation film 47, it is formed so that it may connect with the drain wiring 32 of TFT202 for EL drive in the formed aperture. In addition, if the direct file of the pixel electrode 49 and the drain field 27 is made not to be carried out like drawing 7 , it can prevent the alkali metal of EL layer invading into a barrier layer via a pixel electrode.

[0189] On the pixel electrode 49, while [the 3rd layer] becoming by the oxidization silicon film, the nitriding oxidization silicon film, or the organic resin film, an insulator layer 50 is formed at the thickness which is 0.3-1 micrometer. Between this 3rd layer, the verge of opening **********s so that opening may be prepared by etching on the pixel electrode 49 and an insulator layer 50 may serve as a taper configuration. As for the angle of a taper, it is good to consider as 10-60 degrees (preferably 30-50 degrees).

[0190] On an insulator layer 50, the EL layer 51 is formed between the 3rd layer. It is better for luminous efficiency to use by the laminated structure, although the EL layer

51 was used by the monolayer or the laminated structure. Although generally formed on a pixel electrode in order of a hole-injection layer / electron hole transporting bed / luminous layer / electronic transporting bed, structure like an electron hole transporting bed / luminous layer / electronic transporting bed, or a hole-injection layer / electron hole transporting bed / luminous layer / electronic transporting bed / electron-injection layer is sufficient. In the invention in this application, which well-known structure may be used and fluorescence nature coloring matter etc. may be doped to EL layer.

[0191] As an organic EL material, the material indicated by the following U.S. patents or the open official report can be used, for example. U.S. Pat. No. 4,356,429 U.S. Pat. No. 4,539,507, U.S. Pat. No. 4,720,432 U.S. Pat. No. 4,769,292, U.S. Pat. No. 4,885,211 U.S. Pat. No. 4,950,950, U.S. Pat. No. 5,059,861 U.S. Pat. No. 5,047,687, U.S. Pat. No. 5,073,446 U.S. Pat. No. 5,059,862, U.S. Pat. No. 5,061,617 U.S. Pat. No. 5,151,629, U.S. Pat. No. 5,294,869 U.S. Pat. No. 5,294,870, JP,10-189525,A, JP,8-241048,A, JP,8-78159,A.

[0192] In addition, it roughly divides into an ElectroLuminescent Display and there are four colorization means of displaying. The method which forms three kinds of EL elements corresponding to R(red) G(green) B (blue), The method which combined the method which combined the EL element and light filter of white luminescence, blue, or the EL element and fluorescent substance (color conversion layer of fluorescence nature : CCM) of bluish green luminescence, the method which puts the EL element corresponding to RGB on cathode (counterelectrode) using a transparent electrode, ******.

[0193] The structure of drawing 2 is an example at the time of using the method which forms three kinds of EL elements corresponding to RGB. In addition, although only one pixel is illustrated to drawing 7 , the pixel of the same structure is formed corresponding to each color of red, green, or blue, and, thereby, color display can be performed.

[0194] It is not concerned with a luminescence method, but the invention in this application can be carried out, and can use all the four above-mentioned methods for the invention in this application. However, since afterglow may pose [a speed of response] a problem slow compared with EL, the method of a fluorescent substance which does not use a fluorescent substance is desirable. Moreover, it can say that it is more desirable not to, use the light filter used as the factor on which luminescence brightness is dropped if possible, either.

[0195] The cathode 52 of an EL element is formed on the EL layer 51. The material which contains the small magnesium (Mg), the lithium (Li), or calcium (calcium) of a

work function as cathode 52 is used. What is necessary is just to use the electrode which becomes preferably by MgAg (material which mixed Mg and Ag by Mg:Ag=10:1). A MgAgAl electrode, a LiAl electrode, and a LiFAl electrode are mentioned to others.

[0196] In addition, EL element 206 is formed of the pixel electrode (anode plate) 49, the EL layer 51, and cathode 52.

[0197] Although it is necessary to form individually the layered product which becomes by the EL layer 51 and cathode 52 by each pixel, since the EL layer 51 is very weak for moisture, the usual photolithography technology cannot be used for it. Therefore, it is desirable to form alternatively using physical mask material, such as a metal mask, by gaseous-phase methods, such as a vacuum deposition method, a spatter, and a plasma CVD method.

[0198] In addition, in the present condition, although it is also possible as a method of forming EL layer alternatively to use the ink-jet method, screen printing, or the spin coat method, since these cannot perform continuation formation of cathode, they can be said for the above-mentioned method to be more desirable.

[0199] Moreover, it is a protection electrode, and 53 is an electrode for connecting the cathode 52 of each pixel at the same time it protects cathode 52 from external moisture etc. as a protection electrode 53, aluminum (aluminum), copper (Cu), or silver (Ag) is included -- low -- it is desirable to use material [****] The thermolysis effect which eases generation of heat of EL layer is also expectable in this protection electrode 53.

[0200] 54 [moreover,] -- the 2nd passivation film -- it is -- thickness -- 10nm - 1 micrometer (preferably 200-500nm) -- then, it is good Although the purpose which forms the 2nd passivation film 54 has the main purpose which protects the EL layer 51 from moisture, it is also effective to give the thermolysis effect. However, since EL layer is weak with heat as mentioned above, it is desirable to form membranes if possible at low temperature (preferably temperature requirement from a room temperature to 120 degrees C). Therefore, it can be called the membrane formation method that a plasma CVD method, a spatter, a vacuum deposition method, the ion plating method, or the solution applying method (the spin coating method) is desirable.

[0201] In addition, all TFT illustrated by drawing 7 cannot be overemphasized by that you may have the polysilicon contest film used by the invention in this application as a barrier layer.

[0202] The invention in this application is not limited to the structure of the ElectroLuminescent Display of drawing 7 , and the structure of drawing 7 is only one of the desirable gestalten when carrying out the invention in this application.

[0203] It combines with an example 1 or an example 2 freely, and composition shown in this example can be carried out.

(Example 4)

[0204] this example explains an example different from drawing 7 using drawing 21 about the outline of the cross-section structure of the ElectroLuminescent Display of the invention in this application. this example explains the example using bottom gate type TFT to TFT.

[0205] In drawing 21 , it is the insulator layer (henceforth a ground film) from which 811 becomes a substrate and 812 becomes a ground. As a substrate 811, a glass substrate, a quartz substrate, a crystallized-glass substrate, or a glass-ceramics substrate can be used for a translucency substrate and a representation target. However, you have to bear the highest processing temperature in a production process.

[0206] Moreover, although especially the ground film 812 is effective when using the substrate containing a movable ion, and the substrate which has conductivity, you may not prepare in a quartz substrate. What is necessary is just to use the insulator layer containing silicon (silicon) as a ground film 812. in addition, in this specification, "the insulator layer containing silicon" points out the insulator layer in which predetermined came out of oxygen or nitrogen comparatively, and it was made to specifically contain to silicon, such as an oxidization silicon film, a silicon nitride film, or a nitriding oxidization silicon film (SiOxNy:x and y -- arbitrary integers -- come out and shown)

[0207] 8201 is TFT for switching, 8202 is TFT for EL drive, and it is formed by n channel type TFT and p-channel type TFT, respectively. When the luminescence direction of EL is the inferior surface of tongue (field in which TFT and EL layer are not prepared) of a substrate, it is desirable that it is the above-mentioned composition. However, the invention in this application is not limited to this composition. N channel type TFT, p-channel type TFT, or neither is available for TFT for switching, and TFT for EL drive.

[0208] TFT8201 for switching has a barrier layer including the source field 813, the drain field 814, the LDD fields 815a-815d, an isolation region 816, and the channel formation fields 863a and 864b, the gate insulator layer 818, the gate electrodes 819a and 819b, the insulator layer 820 between the 1st layer, the source signal line 821, and the drain wiring 822. In addition, the gate insulator layer 818 or the insulator layer 820 between the 1st layer may be common to all TFT on a substrate, and may be changed according to a circuit or an element.

[0209] Moreover, the gate electrodes 819a and 819b are connected electrically, and TFT8201 for switching shown in drawing 21 has the so-called double-gate structure. Of course, you may be the so-called multi-gate structures (structure containing the barrier layer which has two or more channel formation fields connected in series), such as not only double-gate structure but triple gate structure.

[0210] Multi-gate structure is very effective when reducing the OFF state current, and if the OFF state current of TFT for switching is made low enough, a minimum capacity which the capacitor connected so much to the gate electrode of TFT8202 for EL drive needs can be stopped. That is, since area of a capacitor can be made small, considering as multi-gate structure is effective when extending the effective luminescence area of an EL element.

[0211] Furthermore, in TFT8201 for switching, the LDD fields 815a-815d are formed so that it may not lap with the gate electrodes 819a and 819b through the gate insulator layer 818. Such structure is very effective when reducing the OFF state current. Moreover, what is necessary is just to set typically 0.5-3.5 micrometers (width of face) of LDD fields [815a-815d] length to 2.0-2.5 micrometers.

[0212] In addition, it is still more desirable to prepare an offset field (field where it becomes in the semiconductor layer of the same composition as a channel formation field, and a gate voltage is not applied) between a channel formation field and a LDD field when lowering the OFF state current. Moreover, in the case of the multi-gate structure of having two or more gate electrodes, the isolation region 816 (field where the same impurity element was added by the same concentration as a source field or a drain field) prepared between channel formation fields is effective for reduction of the OFF state current.

[0213] Next, TFT8202 for EL drive has a barrier layer including the source field 826, the drain field 827, and the channel formation field 805, the gate insulator layer 818, the gate electrode 830, the insulator layer 820 between the 1st layer, and the source signal line 831 and the drain wiring 832, and is formed. In this example, TFT8202 for EL drive is p-channel type TFT.

[0214] Moreover, the drain field 814 of TFT8201 for switching is connected to the gate 830 of TFT8202 for EL drive. Although not illustrated, the gate electrode 830 of TFT8202 for EL drive is specifically electrically connected through the drain field 814 of TFT8201 for switching, and the drain wiring (it can also be called connection wiring) 822. In addition, although the gate electrode 830 has single-gate structure, you may be multi-gate structure. Moreover, the source signal line 831 of TFT8202 for EL drive is connected to a current supply line (not shown).

[0215] TFT8202 for EL drive is an element for controlling the amount of current poured into an EL element, and comparatively much current flows. Therefore, as for channel width (W), it is desirable to design more greatly than the channel width of TFT for switching. Moreover, as for channel length (L), designing for a long time is desirable so that superfluous current may not flow to TFT8202 for EL drive. It is made to be desirably set to 0.5-2microper pixel A (preferably 1-1.5microA).

[0216] Furthermore, you may suppress degradation of TFT by what thickness of the barrier layer (especially channel formation field) of TFT8202 for EL drive is thickened for (preferably 50-100nm, still more preferably 60-80nm). On the contrary, in the case of TFT8201 for switching, if the OFF state current is seen from a viewpoint of making it small, what thickness of a barrier layer (especially channel formation field) is made thin also for (preferably 20-50nm, still more preferably 25-40nm) is effective.

[0217] Although the above explained the structure of TFT established in the pixel, a drive circuit is also simultaneously formed at this time. The CMOS circuit used as the base unit which forms a drive circuit is illustrated by drawing 21 .

[0218] TFT which has the structure of reducing hot carrier pouring is used as n channel type TFT8204 of a CMOS circuit, making it not reduce a working speed as much as possible in drawing 21 . In addition, as a drive circuit here, a source signal side drive circuit and a gate signal side drive circuit are pointed out. Of course, it is also possible to form other logical circuits (a level shifter, an A/D converter, signal dividing network, etc.).

[0219] In the LDD field 837, the barrier layer of n channel type TFT8204 of a CMOS circuit has lapped with the gate electrode 839 through the gate insulator layer 818 including the source field 835, the drain field 836, the LDD field 837, and the channel formation field 862.

[0220] The consideration for not reducing a working speed forms the LDD field 837 only in the drain field 836 side. Moreover, it is better for this n channel type TFT8204 to seldom have cared about the OFF state current value, and to attach greater importance than to it to a working speed. Therefore, as for the LDD field 837, it is desirable to keep in a gate electrode in piles completely, and to lessen a resistance component as much as possible. Namely, it is better to abolish the so-called offset.

[0221] Moreover, since degradation by hot carrier pouring hardly worries p-channel type TFT8205 of a CMOS circuit, it does not need to prepare especially a LDD field. Therefore, as for a barrier layer, on it, the gate insulator layer 818 and the gate electrode 843 are formed including the source field 840, the drain field 841, and the channel formation field 861. Of course, it is also possible to prepare a LDD field like n

channel type TFT8204, and to take the cure against a hot carrier.

[0222] In addition, 817a, 817b, 829, 838, and 842 are the masks for forming the channel formation fields 861, 862, 863, 864, and 805.

[0223] Moreover, n channel type TFT8204 and p-channel type TFT8205 have [on the source field] the source signal lines 844 and 845 through the insulator layer 820 in between between the 1st layer, respectively. Moreover, the drain field of n channel type TFT8204 and p-channel type TFT8205 is mutually connected electrically by the drain wiring 846.

[0224] 847 [next,] -- the 1st passivation film -- it is -- thickness -- 10nm - 1 micrometer (preferably 200-500nm) -- then, it is good As a material, the insulator layer (a nitriding oxidization silicon film or a silicon nitride film is especially desirable) containing silicon can be used. This passivation film 847 has the role metal which protects formed TFT from alkali metal or moisture. Alkali metal, such as sodium, is contained in EL layer finally prepared above TFT (especially TFT for EL drive). That is, the 1st passivation film 847 works also as a protective layer which does not make such alkali metal (movable ion) invade into the TFT side.

[0225] Moreover, 848 is an insulator layer between the 2nd layer, and has the function as a flattening film to perform flattening of the level difference made by TFT. Between the 2nd layer, as an insulator layer 848, an organic resin film is desirable and it is good to use a polyimide, a polyamide, an acrylic, BCB (benz-cyclo-butene), etc. These organic resin films tend to form a good flat side, and specific inductive capacity has an advantage of a low. Since EL layer is very sensitive to irregularity, as for the level difference by TFT, it is desirable to absorb almost by the insulator layer 848 between the 2nd layer. Moreover, when reducing the parasitic capacitance formed between a gate signal line, a data signal line, and the cathode of an EL element, it is desirable to prepare the low material of specific inductive capacity thickly. Therefore, 0.5-5 micrometers (preferably 1.5-2.5 micrometers) of thickness are desirable.

[0226] Moreover, 849 is a pixel electrode (anode plate of an EL element) which becomes by the transparent electric conduction film, and after it reaches insulator layer 848 between the 2nd layer and opens a contact hole (puncturing) in the 1st passivation film 847, it is formed so that it may connect with the drain wiring 832 of TFT8202 for EL drive in the formed aperture. In addition, if the direct file of the pixel electrode 849 and the drain field 827 is made not to be carried out like drawing 21 , it can prevent the alkali metal of EL layer invading into a barrier layer via a pixel electrode.

[0227] On the pixel electrode 849, while [the 3rd layer] becoming by the oxidization

silicon film, the nitriding oxidization silicon film, or the organic resin film, an insulator layer 850 is formed at the thickness which is 0.3-1 micrometer. Between this 3rd layer, the verge of opening **********s so that opening may be prepared by etching on the pixel electrode 849 and an insulator layer 850 may serve as a taper configuration. As for the angle of a taper, it is good to consider as 10-60 degrees (preferably 30-50 degrees).

[0228] On an insulator layer 850, the EL layer 851 is formed between the 3rd layer. It is better for luminous efficiency to use by the laminated structure, although the EL layer 851 was used by the monolayer or the laminated structure. Although generally formed on a pixel electrode in order of a hole-injection layer / electron hole transporting bed / luminous layer / electronic transporting bed, structure like an electron hole transporting bed / luminous layer / electronic transporting bed, or a hole-injection layer / electron hole transporting bed / luminous layer / electronic transporting bed / electron-injection layer is sufficient. In the invention in this application, which well-known structure may be used and fluorescence nature coloring matter etc. may be doped to EL layer.

[0229] The structure of drawing 21 is an example at the time of using the method which forms three kinds of EL elements corresponding to RGB. In addition, although only one pixel is illustrated to drawing 21 , the pixel of the same structure is formed corresponding to each color of red, green, or blue, and, thereby, color display can be performed. It is not concerned with a luminescence method but the invention in this application can be carried out.

[0230] The cathode 852 of an EL element is formed on the EL layer 851. The material which contains the small magnesium (Mg), the lithium (Li), or calcium (calcium) of a work function as cathode 852 is used. What is necessary is just to use the electrode which becomes preferably by MgAg (material which mixed Mg and Ag by Mg:Ag=10:1). A MgAgAl electrode, a LiAl electrode, and a LiFAl electrode are mentioned to others.

[0231] In addition, EL element 8206 is formed of the pixel electrode (anode plate) 849, the EL layer 851, and cathode 852.

[0232] Although it is necessary to form individually the layered product which becomes by the EL layer 851 and cathode 852 by each pixel, since the EL layer 851 is very weak for moisture, the usual photolithography technology cannot be used for it. Therefore, it is desirable to form alternatively using physical mask material, such as a metal mask, by gaseous-phase methods, such as a vacuum deposition method, a spatter, and a plasma CVD method.

[0233] In addition, in the present condition, although it is also possible as a method of

forming EL layer alternatively to use the ink-jet method, screen printing, or the spin coat method, since these cannot perform continuation formation of cathode, they can be said for the above-mentioned method to be more desirable.

[0234] Moreover, it is a protection electrode, and 853 is an electrode for connecting the cathode 852 of each pixel at the same time it protects cathode 852 from external moisture etc. as a protection electrode 853, aluminum (aluminum), copper (Cu), or silver (Ag) is included -- low -- it is desirable to use material [****] The thermolysis effect which eases generation of heat of EL layer is also expectable in this protection electrode 853.

[0235] 854 [moreover,] -- the 2nd passivation film -- it is -- thickness -- 10nm - 1 micrometer (preferably 200-500nm) -- then, it is good Although the purpose which forms the 2nd passivation film 854 has the main purpose which protects the EL layer 851 from moisture, it is also effective to give the thermolysis effect. However, since EL layer is weak with heat as mentioned above, it is desirable to form membranes if possible at low temperature (preferably temperature requirement from a room temperature to 120 degrees C). Therefore, it can be called the membrane formation method that a plasma CVD method, a spatter, a vacuum deposition method, the ion plating method, or the solution applying method (the spin coating method) is desirable.

[0236] In addition, all TFT illustrated by drawing 21 cannot be overemphasized by that you may have the polysilicon contest film used by the invention in this application as a barrier layer.

[0237] The invention in this application is not limited to the structure of the ElectroLuminescent Display of drawing 21 , and the structure of drawing 21 is only one of the desirable gestalten when carrying out the invention in this application.

[0238] It combines with an example 1 or an example 2 freely, and composition shown in this example can be carried out.

[0239] (Example 5) this example explains how to produce simultaneously TFT of the pixel section and the drive circuit section prepared around it. However, in order to simplify explanation, suppose that the CMOS circuit which is a base unit is illustrated about a drive circuit.

[0240] First, as shown in drawing 8 (A), the substrate 501 which prepared the ground film (not shown) in the front face is prepared. On glass ceramics, as a ground film, the laminating of the nitriding oxidization silicon film of 200nm ** is carried out, and the nitriding oxidization silicon film of 100nm ** is used in this example. At this time, it is good to make into 10 - 25wt% nitrogen concentration of the direction which touches a glass-ceramics substrate. Of course, you may form a direct element on a quartz

substrate, without preparing a ground film.

[0241] Next, the amorphous silicon film 502 with a thickness of 45nm is formed by the well-known forming-membranes method on a substrate 501. In addition, what is necessary is just the semiconductor film (a microcrystal semiconductor film is included) which does not need to limit to an amorphous silicon film and includes amorphous structure. The compound semiconductor film which furthermore includes the amorphous structure of an amorphous silicon germanium film etc. is sufficient.

[0242] The process from here to drawing 8 (C) can quote JP,10-247735,A by these people completely. In this official report, the technology about the crystallization method of a semiconductor film of having used elements, such as nickel, as a catalyst is indicated.

[0243] First, the protective coat 504 which has Openings 503a and 503b is formed. In this example, the oxidization silicon film of 150nm ** is used. And the layer (nickel content layer) 505 which contains nickel (nickel) by the spin coat method is formed on a protective coat 504. What is necessary is just to make the aforementioned official report reference about formation of this nickel content layer.

[0244] Next, as shown in drawing 8 (B), 570-degree-C heat-treatment of 14 hours is added in an inert atmosphere, and the amorphous silicon film 502 is crystallized. Under the present circumstances, crystallization advances to a substrate and outline parallel with the fields (henceforth nickel addition field) 506a and 506b as the starting point where nickel touched, and the polysilicon contest film 507 which becomes by the crystal structure with which the cylindrical crystal was gathered and located in a line is formed.

[0245] Next, as shown in drawing 8 (C), the element (preferably Lynn) which belongs to 15 groups by using a protective coat 504 as a mask as it is is added to nickel addition fields 506a and 506b. In this way, the fields (henceforth the Lynn addition field) 508a and 508b where Lynn was added are formed in high concentration.

[0246] Next, as shown in drawing 8 (C), 600-degree-C heat-treatment of 12 hours is added in an inert atmosphere. nickel which exists in the polysilicon contest film 507 with this heat treatment will move, and as an arrow finally shows all for almost, it will be captured to the Lynn addition fields 508a and 508b. This is considered to be a phenomenon by the gettering effect of the metallic element (this example nickel) by Lynn.

[0247] The concentration of nickel which remains into the polysilicon contest film 509 according to this process is reduced by even 2x1017 atoms/cm3 at least with the measured value by SIMS (mass secondary ion analysis). although nickel is a lifetime

killer for a semiconductor, if until reduction is carried out to this extent, it will not have a bad influence on a TFT property at all Moreover, since most of this concentration is the measurement limitation of the present SIMS analysis, it is thought in fact that it is low concentration (three or less 2x1017 atoms/cm) further.

[0248] In this way, the polysilicon contest film 509 reduced by even the level using the catalyst to which it crystallizes and the catalyst does not give trouble to operation of TFT is obtained. Then, the barrier layers 510–513 only using this polysilicon contest film 509 are formed according to a patterning process. Moreover, it is good at this time to form the marker for performing mask alignment in next patterning using the above-mentioned polysilicon contest film. (Drawing 8 (D))

[0249] Next, as shown in drawing 8 (E), the nitriding silicon-oxide film of 50nm ** is formed by the plasma CVD method, 950-degree-C heat-treatment of 1 hour is added in an oxidizing atmosphere on it, and a thermal oxidation process is performed. In addition, oxygen atmosphere is sufficient as an oxidizing atmosphere, and the oxygen atmosphere which added the halogen is sufficient as it.

[0250] At this thermal oxidation process, oxidization advances by the interface of a barrier layer and the above-mentioned nitriding silicon-oxide film, the polysilicon contest film of about 15nm ** oxidizes, and the silicon-oxide film of about 30nm ** is formed. That is, the gate insulator layer 514 of 80nm ** to which it comes to carry out the laminating of the silicon-oxide film of 30nm ** and the nitriding silicon-oxide film of 50nm ** is formed. Moreover, the thickness of barrier layers 510–513 is set to 30nm according to this thermal oxidation process.

[0251] Next, as shown in drawing 9 (A), the resist mask 515 is formed and the impurity element (henceforth p type impurity element) which gives p type to barrier layers 511–513 through the gate insulator layer 514 is added. Boron or a gallium can be used for the element and type target which belong to 13 groups typically as a p type impurity element. This process (it is called a channel dope process) is a process for controlling the threshold voltage of TFT.

[0252] In addition, in this example, boron is added by the ion doping method which carried out plasma excitation without carrying out mass separation of the diboron hexahydride (B–2 H6). Of course, you may use the ion implantation method for performing mass separation. The impurity ranges 516–518 which contain boron according to this process by the concentration of 1x1015 – 1x1018 atoms/cm3 (typically 5x1016 – 5x1017 atoms/cm3) are formed.

[0253] Next, as shown in drawing 9 (B), the resist masks 519a and 519b are formed, and the impurity element (henceforth n type impurity element) which gives n type

through the gate insulator layer 514 is added. In addition, Lynn or arsenic can be used for the element and type target which belong to 15 groups typically as an n type impurity element. In addition, in this example, Lynn is added by the concentration of 1x1018 atoms/cm3 using the plasma doping method which carried out plasma excitation without carrying out mass separation of the phosphoretted hydrogen (PH3). Of course, you may use the ion implantation method for performing mass separation.

[0254] To n type impurity ranges 520 and 521 formed of this process, a dose is adjusted so that n type impurity element may be contained by the concentration of 2x1016 - 5x1019 atoms/cm3 (typically 5x1017 - 5x1018 atoms/cm3).

[0255] Next, as shown in drawing 9 (C), the activation process of added n type impurity element and p type impurity element is performed. Although it is not necessary to limit an activation means, since the gate insulator layer 514 is formed, the furnace annealing processing using the electric heat furnace is desirable. Moreover, since the damage may be given to the barrier layer / gate insulator layer interface of the portion which serves as a channel formation field at the process of drawing 9 (A), it is desirable to heat-treat at as high temperature as possible.

[0256] Since heat-resistant high glass ceramics are used in the case of this example, 800-degree-C processing [furnace annealing] of 1 hour performs an activation process. In addition, you may oxidize thermally by making processing atmosphere into an oxidizing atmosphere, and may heat-treat by the inert atmosphere.

[0257] The boundary section (joint) with the field (p type impurity range formed at the process of drawing 9 (A)) which has not added n type impurity element which exists in the edge of n type impurity ranges 520 and 521, i.e., the circumference of n type impurity ranges 520 and 521, according to this process becomes clear. This means that a LDD field and a channel formation field can form a very good joint, when TFT is completed behind.

[0258] Next, patterning of the electric conduction film of 200-400nm ** is formed and carried out, and the gate electrodes 522-525 are formed. The length of the channel length of each TFT is determined by line breadth of these gate electrodes 522-525.

[0259] In addition, although a gate electrode may be formed by the electric conduction film of a monolayer, it is desirable to consider as cascade screens, such as a bilayer and three layers, if needed. An electric conduction film well-known as a material of a gate electrode can be used. Specifically Aluminum (aluminum), a tantalum (Ta), titanium (Ti), Molybdenum (Mo), a tungsten (W), chromium (Cr), the film that becomes by the element chosen from silicon (Si), or the film (typical -- a tantalum-nitride film and a nitriding tungsten film --) which becomes by the nitride of the aforementioned

element A titanium-nitride film, the alloy film (typically a Mo-W alloy, a Mo-Ta alloy) which combined the aforementioned element, or the silicide film (typically a tungsten silicide film, a titanium silicide film) of the aforementioned element can be used. Of course, even if it uses by the monolayer, a laminating may be carried out and you may use.

[0260] In this example, the cascade screen which becomes by the nitriding tungsten (WN) film of 50nm ** and the tungsten (W) film of 350nm ** is used. What is necessary is just to form this by the spatter. Moreover, if inert gas, such as a xenon (Xe) and neon (Ne), is added as spatter gas, film peeling by stress can be prevented.

[0261] Moreover, at this time, the gate electrodes 523 and 525 are formed so that it may lap through the part and the gate insulator layer 514 of n type impurity ranges 520 and 521, respectively. This overlapping portion serves as a LDD field which lapped with the gate electrode behind. In addition, the gate electrodes 524a and 524b are electrically connected in practice, although it is visible to two in a cross section.

[0262] Next, as shown in drawing 10 (A), n type impurity element (this example Lynn) is added on a self-adjustment target by using the gate electrodes 522-525 as a mask. In this way, to the impurity ranges 527-533 formed, it adjusts so that Lynn may be added by the concentration of 1 / 2 - 1/10 of n type impurity ranges 520 and 521 (typically 1 / 3 - 1/4). Specifically, the concentration of 1x1016 - 5x1018 atoms/cm3 (typically 3x1017 - 3x1018 atoms/cm3) is desirable.

[0263] Next, as shown in drawing 10 (B), the resist masks 534a-534d are formed for a gate electrode etc. with a wrap form, and the impurity ranges 535-541 which add n type impurity element (this example Lynn), and include Lynn in high concentration are formed. It carries out by the ion doping method for having used the phosphoretted hydrogen (PH3) also here, and the concentration of Lynn of this field is adjusted so that it may become 1x1020 - 1x1021 atoms/cm3 (typically 2x1020 - 5x1021 atoms/cm3).

[0264] Although the source field or drain field of n channel type TFT is formed of this process, TFT for switching leaves a part of n type impurity ranges 530-532 formed at the process of drawing 10 (A). This left-behind field is equivalent to the LDD field of TFT for switching.

[0265] Next, as shown in drawing 10 (C), the resist masks 534a-534c are removed, and the resist mask 543 is newly formed. And p type impurity element (this example boron) is added, and the impurity ranges 544 and 545 which contain boron in high concentration are formed. Here, boron is added so that it may become 3x1020 - 3x1021 atoms/cm3 (typically 5x1020 - 1x1021 atoms/cm3 NO) concentration by the

ion doping method for having used the diboron hexahydride (B-2 H6).

[0266] In addition, although Lynn is already added by impurity ranges 544 and 545 by the concentration of 1x1020 - 1x1021 atoms/cm3, the boron added here is added by the concentration of at least 3 times or more. Therefore, it is completely reversed to P type, and the n type impurity range currently formed beforehand functions as an impurity range of P type.

[0267] Next, as shown in drawing 10 (D), after removing the resist mask 543, an insulator layer 546 is formed between the 1st layer. What is necessary is just to use the cascade screen which used the insulator layer containing silicon by the monolayer, or was combined in it as an insulator layer 546 between the 1st layer. Moreover, thickness is just 400nm - 1.5 micrometers. In this example, it considers as the structure which carried out the laminating of the oxidization silicon film of 800nm ** on the nitriding oxidization silicon film of 200nm **.

[0268] Then, n type or p type impurity element added by each concentration is activated. As an activation means, the furnace annealing method is desirable. In this example, 550 degrees C and heat treatment of 4 hours are performed among nitrogen-gas-atmosphere mind in an electric heat furnace.

[0269] Furthermore, in the atmosphere containing 3 - 100% of hydrogen, heat treatment of 1 - 12 hours is performed at 300-450 degrees C, and a hydrogen treating is performed. This process is a process which carries out hydrogen termination of the azygos joint hand of a semiconductor film by the hydrogen excited thermally. As other meanses of hydrogenation, you may perform plasma hydrogenation (the hydrogen excited by plasma is used).

[0270] In addition, while forming an insulator layer 546 between the 1st layer, you may put in a hydrogen treating. That is, after forming the nitriding oxidization silicon film of 200nm **, a hydrogen treating may be performed as mentioned above, and it may remain after that, and the oxidization silicon film of 800nm ** may be formed.

[0271] Next, as shown in drawing 11 (A), a contact hole is formed to an insulator layer 546 between the 1st layer, and the source signal lines 547-550 and the drain wiring 551-553 are formed. In addition, it considers as the cascade screen of the three-tiered structure which carried out the aluminum film which contains [this electrode] 100nm and Ti for Ti film by 300nm at this example, and carried out continuation formation of the 150nm of the Ti films by the spatter. Of course, other electric conduction films are sufficient.

[0272] Next, the 1st passivation film 554 is formed by the thickness of 50-500nm (typically 200-300nm). In this example, the nitriding silicon-oxide film of 300nm ** is

used as the 1st passivation film 554. You may substitute a silicon nitride film for this.
[0273] At this time, it is effective to perform plasma treatment using the gas which contains H2 and NH3 grade hydrogen in advance of formation of a nitriding silicon-oxide film. The membraneous quality of the 1st passivation film 554 is improved because the hydrogen excited by this pretreatment heat-treats by supplying an insulator layer 546 between the 1st layer. Since the hydrogen added by the insulator layer 546 between the 1st layer is spread in a lower layer side simultaneously with it, a barrier layer can be hydrogenated effectively.
[0274] Next, as shown in drawing 11 (B), while [the 2nd layer] consisting of an organic resin, an insulator layer 555 is formed. As an organic resin, a polyimide, an acrylic, BCB (benz-cyclo-butene), etc. can be used. Between the 2nd layer, since especially the insulator layer 555 needs to carry out flattening of the level difference which TFT forms, its acrylic film excellent in flat nature is desirable. At this example, an acrylic film is formed by the thickness of 2.5 micrometers.
[0275] The contact hole which reaches the drain wiring 553 is formed in an insulator layer 555 and the 1st passivation film 554 between the 2nd layer, and, next, the protection electrode 556 is formed. What is necessary is just to use the electric conduction film which makes aluminum a principal component as a protection electrode 556. What is necessary is just to form the protection electrode 556 by the vacuum deposition method.
[0276] Next, the insulator layer (this example oxidization silicon film) containing silicon is formed in the thickness of 500nm, opening is formed in the position corresponding to the portion used as a pixel electrode, and an insulator layer 557 is formed between the 3rd layer. In case opening is formed, it can consider as the side attachment wall of a taper configuration easily by using the wet etching method. If the side attachment wall of opening is not fully gently-sloping, degradation of EL layer resulting from a level difference will pose a remarkable problem.
[0277] Next, the counterelectrode (MgAg electrode) 558 which is the cathode of an EL element is formed. Using a vacuum deposition method, the MgAg electrode 558 is formed so that it may be thin to 180-300nm (typically 200-250nm).
[0278] Next, the EL layer 559 is formed without carrying out air release using a vacuum deposition method. In addition, the thickness of the EL layer 559 should just make 80-200nm (typically 100-120nm) and the pixel electrode (anode plate) 560 the thickness of 110nm.
[0279] At the thing process in this example, EL layer and a pixel electrode (anode plate) are formed one by one to the pixel corresponding to red, the pixel which

corresponds green, and the pixel which corresponds blue. however, the ** which does not use photolithography technology since EL layer is lacking in the resistance over a solution -- each color -- you have to form individually Then, it is desirable that hide except a desired pixel using a metal mask, and only a required part forms EL layer and a pixel electrode (anode plate) alternatively.

[0280] That is, the mask which hides except [all] the pixel corresponding to red first is set, and EL layer and the pixel electrode (anode plate) of red luminescence are alternatively formed using the mask. Subsequently, the mask which hides except [all] the pixel which corresponds green is set, and EL layer and the pixel electrode (anode plate) of green luminescence are alternatively formed using the mask. Subsequently, the mask which hides except [all] the pixel which corresponds blue similarly is set, and EL layer and the pixel electrode (anode plate) of blue luminescence are alternatively formed using the mask. In addition, although it has indicated that a mask which is altogether different here is used, you may use the same mask about. Moreover, processing without breaking a vacuum is desirable until it forms EL layer and a pixel electrode (anode plate) in all pixels.

[0281] In addition, a material well-known as an EL layer 559 can be used. As a well-known material, when driver voltage is taken into consideration, it is desirable to use an organic material. For example, what is necessary is just to let four layer structures which become in a hole-injection layer, an electron hole transporting bed, a luminous layer, and an electron-injection layer be EL layers. Moreover, in this example, an indium-tin-oxide (ITO) film is formed as a pixel electrode (anode plate) 560 of an EL element. Moreover, the transparent electric conduction film which mixed 2 - 20% of zinc oxide (ZnO) may be used for indium oxide, and you may be well-known other materials.

[0282] The 2nd passivation film 561 which becomes the last by the silicon nitride film is formed in the thickness of 300nm.

[0283] In this way, the ElectroLuminescent Display of structure as shown in drawing 11 (C) is completed. In addition, in fact, when completing to drawing 11 (C), it is desirable to carry out packaging (enclosure) by housing material, such as airtight high protection films (a laminate film, ultraviolet-rays hardening resin film, etc.) and a sealing can made from ceramics, so that the open air may not ** further. In that case, the interior of housing material is made into an inert atmosphere, or the reliability (life) of EL layer improves by arranging a hygroscopic material (for example, barium oxide) inside.

[0284] Moreover, if processing of packaging etc. raises airtightness, the connector

(flexible print circuit : FPC) for connecting the terminal and external signal terminal which were taken about from the element formed on the substrate or the circuit will be attached, and it will complete as a product. The ElectroLuminescent Display changed into such a state where it can ship is called EL module in this specification.

[0285] It combines with an example 1 or an example 2 freely, and composition shown in this example can be carried out.

[0286] (Example 6)

[0287] this example explains the composition of the ElectroLuminescent Display of the invention in this application using the perspective diagram of drawing 12 .

[0288] The ElectroLuminescent Display of this example consists of the pixel section 3202 formed on the glass substrate 3201, a gate signal side drive circuit 3203, and a source side drive circuit 3204. TFT3205 for switching of the pixel section 3202 is n channel type TFT, and is arranged at the intersection of the gate signal line 3206 connected to the gate signal side drive circuit 3203, and the source signal line 3207 connected to the source side drive circuit 3204. Moreover, the drain field of TFT3205 for switching is connected to the gate of TFT3208 for EL drive.

[0289] Furthermore, the source field of TFT3208 for EL drive is connected to the current supply line 3209. Moreover, the capacitor 3216 connected to the gate field and the current supply line 3209 of TFT3208 for EL drive is formed. Power supply potential is applied to the current supply line 3209 in this example. Moreover, the counterelectrode (this example cathode) of this EL element 3211 is maintained at the stationary potential (this example 0 V).

[0290] And the I/O wiring (connection wiring) 3213 and 3214 for transmitting a signal to a drive circuit and the I/O wiring 3215 connected to the current supply line 3209 are formed in FPC3212 used as an external I/O terminal.

[0291] Furthermore, EL module of this example also including housing material is explained using drawing 13 (A) and (B). In addition, the sign used by drawing 12 if needed will be quoted.

[0292] On the glass substrate 3201, the pixel section 3202, the gate signal side drive circuit 3203, and the source signal side drive circuit 3204 are formed. The various wiring from each drive circuit results in FPC3212 through the I/O wiring 3213-3215, and is connected to an external instrument.

[0293] this time -- at least -- the pixel section 3202 -- as the drive circuits 3203 and 3204 and the pixel section 3202 are surrounded preferably, the housing material 3304 is formed In addition, outside an EL element, rather than **, inside dimension is the configuration or the sheet configuration of having a large crevice, and with adhesives

3305, as the housing material 3304 forms a closed space in collaboration with a glass substrate 3201, it fixes to a glass substrate 3201. At this time, an EL element will be in the state where it was completely enclosed with the aforementioned closed space, and will be completely intercepted from the open air. In addition, you may form two or more housing material 3304.

[0294] Moreover, the quality of the material of the housing material 3304 has desirable insulating matter, such as glass and polymer. For example, amorphous glass (******** glass, quartz, etc.), glass ceramics, ceramic glass, organic system resins (an acrylic resin, a styrene resin, a polycarbonate system resin, epoxy system resin, etc.), and a silicone system resin are mentioned. Moreover, you may use ceramics. Moreover, it is also possible to use metallic materials, such as an oak stainless alloy whose adhesives 3305 are insulating matter.

[0295] Moreover, the quality of the material of adhesives 3305 can use adhesives, such as an epoxy system resin and an acrylate system resin. Furthermore, thermosetting resin and a photoresist can also be used as adhesives. However, it is required to be the quality of the material which does not penetrate oxygen and moisture as much as possible.

[0296] Furthermore, as for the opening 3306 between the housing material 3304 and a glass substrate 3201, it is desirable to be filled up with inert gas (an argon, helium, nitrogen, etc.). Moreover, it is possible not only gas but to use inactive liquids (representing [by the perfluoro alkane] liquefied fluoridation carbon etc.). It is good with material which is used by JP,8-78519,A about the inactive liquid.

[0297] Moreover, it is also effective in an opening 3306 to prepare a drying agent. Material which is indicated by JP,9-148066,A as a drying agent can be used. Generally, the barium oxide is used.

[0298] Moreover, as shown in drawing 13 (B), two or more pixels which have the EL element isolated separately are prepared in the pixel section, and they all have the protection electrode 3307 as a common electrode. Although [this example] it is desirable to carry out continuation formation without carrying out air release of EL layer, cathode (MgAg electrode), and the protection electrode, you may form EL layer and cathode using the same mask material.

[0299] It is not necessary to prepare EL layer and cathode on a drive circuit that what is necessary is to prepare only on the pixel section at this time. Of course, it is more desirable not to prepare, if it takes into consideration that alkali metal is contained in EL layer, although it does not become a problem even if prepared on the drive circuit.

[0300] In addition, the protection electrode 3307 is connected to the I/O wiring 3310

in the field shown by 3308 through the connection wiring 3309 which becomes with the same material as a pixel electrode. The I/O wiring 3310 is a current supply line for applying power supply potential to the protection electrode 3307, and is connected to FPC3212 through the conductive paste material 3311.

[0301] It combines with an example 1 freely and composition shown in this example can be carried out.

[0302] (Example 7) this example explains the composition of the pixel of the ElectroLuminescent Display in the invention in this application.

[0303] Two or more pixels are arranged by the shape of a matrix at the pixel section of the ElectroLuminescent Display in the invention in this application. An example of the circuit diagram of a pixel is shown in drawing 17 (A). In drawing 17 (A), TFT1001 for switching is formed in the pixel 1000. In addition, in the invention in this application, TFT1001 for switching can use n channel type TFT, p-channel type TFT, or either. N channel type TFT is used for TFT1001 for switching in drawing 17 (A). The gate electrode of TFT1001 for switching is connected to the gate signal line 1002 which inputs a gate signal. The source field and drain field of TFT1001 for switching are connected to the data signal line (it is also called a source signal line) 1003 into which one side inputs an analog or a digital video signal. Moreover, another side is connected to the gate electrode of TFT1004 for EL drive.

[0304] One side is connected to the current supply line 1005 for the source field and drain field of TFT1004 for EL drive, and a drain field is connected to EL element 1006 for another side.

[0305] EL element 1006 becomes in EL layer prepared between an anode plate, cathode, and an anode plate and cathode. In addition, in the invention in this application, when an anode plate is [cathode] a counterelectrode in a pixel electrode, the source field or drain field of TFT1004 for EL drive is connected to the anode plate of EL element 1006. Conversely, by the counterelectrode, as for the source field or drain field of TFT1004 for EL drive, cathode is connected to the cathode of EL element 1006 for it, when an anode plate is a pixel electrode. In addition, although TFT1004 for EL drive can use n channel type TFT, p-channel type TFT, or either, when the anode plate of EL element 1006 is [cathode] a counterelectrode in a pixel electrode, it is desirable [TFT1004 for EL drive] that it is p-channel type TFT. Moreover, when the anode plate of EL element 1006 is [cathode] a pixel electrode in a counterelectrode conversely, as for TFT1004 for EL drive, it is desirable that it is n channel type TFT. In drawing 17 (A), p-channel type TFT is used for TFT1004 for EL drive, and the cathode of EL element 1006 is connected to the regular power supply

1007.

[0306] Moreover, a LDD field may be prepared into the barrier layer of TFT1004 for EL drive, and the field (Lov field) with which a LDD field and a gate electrode lap through a gate insulator layer may be formed. When especially TFT1004 for EL drive is n channel type TFT, the ON state current can be made to increase by forming a Lov field in the drain field side of a barrier layer, and capacity can be formed between the gate electrode of TFT1004 for EL drive, and a Lov field.

[0307] Moreover, when TFT1001 for switching is in the state (state of OFF) where it does not choose, in order to hold the gate voltage of TFT1004 for EL drive, you may form a capacitor. When forming a capacitor, a capacitor is connected between the current supply lines 1005 the direction which is not connected to the source signal line of the source field of TFT1001 for switching, and a drain field. In the circuit diagram shown in drawing 17 (A), the current supply line 1005 is located in a line in parallel with the source signal line 1003.

[0308] When the thickness of 22micrometerx22micrometer and a gate insulator layer is [the specific inductive capacity of 800A and a gate insulator layer] 4.1 for the size of a pixel in order to use the Lov field of TFT for EL drive as a capacitor for holding the gate voltage of TFT1004 for EL drive for example, the capacity value of about 19.8 fF(s) is required. Therefore, the area (area with which a LDD field and a gate electrode lap through a gate insulator layer) of a Lov field is needed about 66-micrometer2.

[0309] In addition, in the circuit diagram shown in drawing 17 (A), it is good also considering TFT1001 for switching, or TFT1004 for EL drive as multi-gate structure (structure containing the barrier layer which has two or more channel formation fields connected in series). The circuit diagram of the pixel which made TFT1001 for switching of the pixel shown in drawing 17 (A) multi-gate structure is shown in drawing 18 (A).

[0310] TFT1101a for switching and TFT1101b for switching connect in series, and are prepared. The circuit diagram and composition which were shown in drawing 17 (A) are the same except TFT1101a for switching, and 1101b. The OFF state current can be lowered by making TFT for switching into multi-gate structure. In addition, although considered as double-gate structure in drawing 18 (A), this example is not limited to DABURUGETO and should just be multi-gate structure.

[0311] Moreover, although not shown in drawing, when TFT for EL drive is made into multi-gate structure, degradation of TFT for EL drive by heat can be suppressed.

[0312] Next, another example of the circuit diagram of the pixel of the invention in this application is shown in drawing 17 (B). In drawing 17 (B), TFT1101 for switching is

formed in the pixel 1100. In addition, in the invention in this application, TFT1101 for switching can use n channel type TFT, p-channel type TFT, or either. N channel type TFT is used for TFT1101 for switching in drawing 17 (B). The gate electrode of TFT1101 for switching is connected to the gate signal line 1102 which inputs a gate signal. The source field of TFT1101 for switching or the drain field is connected to the data signal line (it is also called a source signal line) 1103 which inputs an analog or a digital video signal. Moreover, another side is connected to the gate electrode of TFT1104 for EL drive.

[0313] And one side is connected to the current supply line 1105 for the source field and drain field of TFT1104 for EL drive, and another side is connected to EL element 1106.

[0314] EL element 1106 becomes in EL layer prepared between an anode plate, cathode, and an anode plate and cathode. In addition, in the invention in this application, when an anode plate is [cathode] a counterelectrode in a pixel electrode, the source field or drain field of TFT1104 for EL drive is connected to the anode plate of EL element 1106. Conversely, by the counterelectrode, as for the source field or drain field of TFT1104 for EL drive, cathode is connected to the cathode of EL element 1106 for it, when an anode plate is a pixel electrode. In addition, although TFT1104 for EL drive can use n channel type TFT, p-channel type TFT, or either, when the anode plate of EL element 1106 is [cathode] a counterelectrode in a pixel electrode, it is desirable [TFT1104 for EL drive] that it is p-channel type TFT. Moreover, when the anode plate of EL element 1106 is [cathode] a pixel electrode in a counterelectrode conversely, as for TFT1104 for EL drive, it is desirable that it is n channel type TFT. In drawing 17 (B), p-channel type TFT is used for TFT1104 for EL drive, and the cathode of EL element 1106 is connected to the regular power supply 1107.

[0315] Moreover, a LDD field may be prepared into the barrier layer of TFT1104 for EL drive, and the field (Lov field) with which a LDD field and a gate electrode lap through a gate insulator layer may be formed. When especially TFT1104 for EL drive is n channel type TFT, the ON state current can be made to increase by forming a Lov field in the drain field side of a barrier layer, and capacity can be formed between the gate electrode of TFT1104 for EL drive, and a Lov field.

[0316] Moreover, when TFT1101 for switching is in the state (state of OFF) where it does not choose, in order to hold the gate voltage of TFT1104 for EL drive, you may form a capacitor. When forming a capacitor, a capacitor is connected between the current supply lines 1105 the direction which is not connected to the source signal

line of the source field of TFT1101 for switching, and a drain field. In the circuit diagram shown in drawing 17 (B), the current supply line 1105 is located in a line in parallel with the gate signal line 1102.

[0317] In addition, in the circuit diagram shown in drawing 17 (B), it is good also considering TFT1101 for switching, or TFT1104 for EL drive as multi-gate structure. The circuit diagram of the pixel which made TFT1101 for switching of the pixel shown in drawing 17 (B) multi-gate structure is shown in drawing 18 (B).

[0318] TFT1101a for switching and TFT1101b for switching connect in series, and are prepared. The circuit diagram and composition which were shown in drawing 17 (B) are the same except TFT1101a for switching, and 1101b. The OFF state current can be lowered by making TFT for switching into multi-gate structure. In addition, although considered as double-gate structure in drawing 18 (B), this example is not limited to DABURUGETO and should just be multi-gate structure.

[0319] Moreover, although not shown in drawing, when TFT for EL drive is made into multi-gate structure, degradation of TFT for EL drive by heat can be suppressed.

[0320] Next, another example of the circuit diagram of the pixel of the invention in this application is shown in drawing 19 (A). In drawing 19 (A), a pixel 1200 and a pixel 1210 adjoin and are prepared. In drawing 19 (A), 1201 and 1211 are TFT for switching. In addition, in the invention in this application, TFT 1201 and 1211 for switching can use n channel type TFT, p-channel type TFT, or either. N channel type TFT is used for TFT 1201 and 1211 for switching in drawing 19 (A). The gate electrode of TFT 1201 and 1211 for switching is connected to the gate signal line 1202 which inputs a gate signal. The source field and drain field of TFT 1201 and 1211 for switching are connected to the data signal lines (it is also called a source signal line) 1203 and 1204 into which one side inputs an analog or a digital video signal, respectively. Moreover, another side is connected to the gate electrode of TFT 1204 and 1214 for EL drive, respectively.

[0321] And one side of the source field of TFT 1204 and 1214 for EL drive and a drain field is connected to the current supply line 1220, and another side is connected to EL elements 1205 and 1215, respectively. Thus, at this example, two adjacent pixels are sharing one current supply line 1220. Thereby, the number of current supply lines can be reduced compared with the composition shown by drawing 17 and drawing 18 . If the rate over the whole pixel section of wiring is small, when wiring is formed in the direction in which EL layer emits light, cover of the light by wiring is suppressed.

[0322] EL elements 1205 and 1215 become in EL layer prepared between an anode plate, cathode, and an anode plate and cathode, respectively. In addition, in the

invention in this application, when an anode plate is [cathode] a counterelectrode in a pixel electrode, the source field or drain field of TFT 1204 and 1214 for EL drive is connected to the anode plate of EL elements 1205 and 1215. Conversely, by the counterelectrode, as for the source field or drain field of TFT 1204 and 1214 for EL drive, cathode is connected to the cathode of EL elements 1205 and 1215 for it, when an anode plate is a pixel electrode. In addition, although TFT 1204 and 1214 for EL drive can use n channel type TFT, p-channel type TFT, or either, when the anode plate of EL elements 1205 and 1215 is [cathode] a counterelectrode in a pixel electrode, it is desirable [TFT 1204 and 1214 for EL drive] that it is p-channel type TFT. Moreover, when the anode plate of EL elements 1205 and 1215 is [cathode] a pixel electrode in a counterelectrode conversely, as for TFT 1204 and 1214 for EL drive, it is desirable that it is n channel type TFT. In drawing 19 (A), p-channel type TFT is used for TFT 1204 and 1214 for EL drive, and the cathode of EL elements 1205 and 1215 is connected to the regular power supplies 1206 and 1216.

[0323] Moreover, a LDD field may be prepared into the barrier layer of TFT 1204 and 1214 for EL drive, and the field (Lov field) with which a LDD field and a gate electrode lap through a gate insulator layer may be formed. When especially TFT1204 for EL drive is n channel type TFT, the ON state current can be made to increase by forming a Lov field in the drain field side of a barrier layer, and capacity can be formed between the gate electrode of TFT1204 for EL drive, and a Lov field.

[0324] Moreover, when TFT 1201 and 1211 for switching is in the state (state of OFF) where it does not choose, in order to hold the gate voltage of TFT 1204 and 1214 for EL drive, you may form a capacitor. When forming a capacitor, a capacitor is connected between the current supply lines 1220 the direction which is not connected to the source signal line of the source field of TFT1201 for switching, and a drain field.

[0325] In addition, in the circuit diagram shown in drawing 19 (A), it is good also considering TFT 1201 and 1211 for switching, or TFT 1204 and 1214 for EL drive as multi-gate structure. The circuit diagram of the pixel which made TFT 1201 and 1211 for switching of the pixel shown in drawing 19 (A) multi-gate structure is shown in drawing 20 (A).

[0326] TFT1201a for switching and TFT1201b for switching connect in series, and are prepared. Moreover, TFT1211a for switching and TFT1211b for switching connect in series, and are prepared. The circuit diagram and composition which were shown in drawing 19 (A) are the same except TFT 1201a and 1201b for switching, TFT1211a for switching, and 1211b. The OFF state current can be lowered by making TFT for

switching into multi-gate structure. In addition, although considered as double-gate structure in drawing 20 (A), this example is not limited to DABURUGETO and should just be multi-gate structure.

[0327] Moreover, although not shown in drawing, when TFT for EL drive is made into multi-gate structure, degradation of TFT for EL drive by heat can be suppressed.

[0328] Next, another example of the circuit diagram of the pixel of the invention in this application is shown in drawing 19 (B). In drawing 19 (B), a pixel 1300 and a pixel 1310 adjoin and are prepared. In drawing 19 (B), 1301 and 1311 are TFT for switching. In addition, in the invention in this application, TFT 1301 and 1311 for switching can use n channel type TFT, p-channel type TFT, or either. N channel type TFT is used for TFT 1301 and 1311 for switching in drawing 19 (B). The gate electrode of TFT 1301 and 1311 for switching is connected to the gate signal lines 1302 and 1312 which input a gate signal, respectively. The source field and drain field of TFT 1301 and 1311 for switching are connected to the data signal line (it is also called a source signal line) 1303 into which one side inputs an analog or a digital video signal, respectively. Moreover, another side is connected to the gate electrode of TFT 1304 and 1314 for EL drive, respectively.

[0329] And one side is connected to the current supply line 1320 for the source field and drain field of TFT 1304 and 1314 for EL drive, and another side is connected to EL elements 1305 and 1315, respectively. Thus, at this example, two adjacent pixels are sharing one current supply line 1320. Thereby, the number of current supply lines can be reduced compared with the composition shown by drawing 17 and drawing 18 . If the rate over the whole pixel section of wiring is small, when wiring is formed in the direction in which EL layer emits light, cover of the light by wiring is suppressed. And in the circuit diagram shown in drawing 20 (B), the current supply line 1320 is located in a line in parallel with the gate signal lines 1302 and 1312.

[0330] EL elements 1305 and 1315 become in EL layer prepared between an anode plate, cathode, and an anode plate and cathode, respectively. In addition, in the invention in this application, when an anode plate is [cathode] a counterelectrode in a pixel electrode, the source field or drain field of TFT 1304 and 1314 for EL drive is connected to the anode plate of EL elements 1305 and 1315. Conversely, by the counterelectrode, as for the source field or drain field of TFT 1304 and 1314 for EL drive, cathode is connected to the cathode of EL elements 1305 and 1315 for it, when an anode plate is a pixel electrode. In addition, although the objects 1304 and 1314 for EL drive can use n channel type TFT, p-channel type TFT, or either, when the anode plate of EL elements 1305 and 1315 is [cathode] a counterelectrode in a pixel

electrode, it is desirable [TFT 1304 and 1314 for EL drive] that it is p-channel type TFT. Moreover, when the anode plate of EL elements 1305 and 1315 is [cathode] a pixel electrode in a counterelectrode conversely, as for TFT 1304 and 1314 for EL drive, it is desirable that it is n channel type TFT. In drawing 19 (B), p-channel type TFT is used for TFT 1304 and 1314 for EL drive, and the cathode of EL elements 1305 and 1315 is connected to the regular power supplies 1306 and 1316.

[0331] Moreover, a LDD field may be prepared into the barrier layer of TFT 1304 and 1314 for EL drive, and the field (Lov field) with which a LDD field and a gate electrode lap through a gate insulator layer may be formed. When especially TFT 1304 and 1314 for EL drive is n channel type TFT, the ON state current can be made to increase by forming a Lov field in the drain field side of a barrier layer, and capacity can be formed between the gate electrode of TFT 1304 and 1314 for EL drive, and a Lov field.

[0332] Moreover, when TFT 1301 and 1311 for switching is in the state (state of OFF) where it does not choose, in order to hold the gate voltage of TFT 1304 and 1314 for EL drive, you may form a capacitor. When forming a capacitor, a capacitor is connected between the current supply lines 1320 the direction which is not connected to the source signal line of the source field of TFT 1301 and 1311 for switching, and a drain field.

[0333] In addition, in the circuit diagram shown in drawing 19 (B), it is good also considering TFT 1301 and 1311 for switching, or TFT 1304 and 1314 for EL drive as multi-gate structure. The circuit diagram of the pixel which made TFT 1301 and 1311 for switching of the pixel shown in drawing 19 (B) multi-gate structure is shown in drawing 20 (B).

[0334] TFT1301a for switching and TFT1301b for switching connect in series, and are prepared. Moreover, TFT1311a for switching and TFT1311b for switching connect in series, and are prepared. The circuit diagram and composition which were shown in drawing 19 (B) are the same except TFT 1301a and 1301b for switching, TFT1311a for switching, and 1311b. The OFF state current can be lowered by making TFT for switching into multi-gate structure. In addition, although considered as double-gate structure in drawing 20 (B), this example is not limited to DABURUGETO and should just be multi-gate structure.

[0335] Moreover, although not shown in drawing, when TFT for EL drive is made into multi-gate structure, degradation of TFT for EL drive by heat can be suppressed.

[0336] In addition, in this example, you may prepare a resistor between the drain field of TFT for EL drive, and the pixel electrode which an EL element has. By preparing a resistor, the amount of current supplied to an EL element from TFT for EL drive is

controlled, and it becomes possible to prevent the influence of the variation in the property of TFT for EL drive. If a resistor is an element which shows resistance larger enough than the on resistance of TFT for EL drive, since it is good, there will be no limitation in structure etc. In addition, an on resistance is the value which broke the drain voltage of TFT by the drain current which is flowing then, when TFT is in the state of ON. What is necessary is just to choose from the range of 1kohm–50M omega (preferably 10 k ohm – 10 M omega, still more preferably 50 k ohm – 1 M omega) as resistance of a resistor. When a semiconductor layer with resistance high as a resistor is used, formation is easy and desirable.

[0337] It combines with examples 1, 3, 4, 5, or 6 freely, and composition shown in this example can be carried out.

[0338] (Example 8) The invention in this application is not limited to organic EL material, but even if it uses inorganic EL material, it can be carried out. However, since driver voltage is very high, the present inorganic EL material must use TFT which has the proof–pressure property that such driver voltage can be borne.

[0339] Or if inorganic EL material with prospective still lower driver voltage is developed, applying to the invention in this application is possible.

[0340] Moreover, the composition of this example can combine which composition of examples 1–7 freely.

[0341] (Example 9) In the invention in this application, even if the organic substance used as an EL layer is a low–molecular system organic substance, it may be a polymer system (macromolecule system) organic substance. The material [organic substance / low–molecular system] consisting mainly of Alq3 (tris–8–KINORI light–aluminum), TPD (triphenylamine derivative), etc. is known. The matter of pi conjugate polymer system is mentioned as a polymer system organic substance. Typically, PPV (polyphenylene vinylene), PVK (polyvinyl carbazole), a polycarbonate, etc. are mentioned.

[0342] A polymer system (macromolecule system) organic substance can be formed by the simple thin film formation methods, such as the spin coating method (it is also called the solution applying method), a dipping method, the dispensing method, print processes, or the ink–jet method, and its thermal resistance is high compared with a low–molecular system organic substance.

[0343] moreover, EL layer which the EL element has in the EL element which the ElectroLuminescent Display of the invention in this application has –– an electronic transporting bed –– raw –– a hole –– the case where it has the transporting bed –– an electronic transporting bed –– raw –– a hole –– a transporting bed may consist of

amorphous semiconductors, such as an inorganic material, for example, amorphous Si, or amorphous Si1−xCx

[0344] A lot of interface level is formed in the interface to which a lot of trap levels exist in an amorphous semiconductor, and an amorphous semiconductor touches other layers. Therefore, an EL element can also attain high brightness−ization while being able to make it emit light on low voltage.

[0345] Moreover, a dopant (impurity) may be added in organic EL layer, and the color of luminescence of organic EL layer may be changed. As a dopant, DCM1, the Nile red, rubrene, a coumarin 6, TPB, a Quinacridone, etc. are mentioned.

[0346] Moreover, the composition of this example can combine which composition of examples 1−7 freely.

[0347] (Example 10) The another drive method of the ElectroLuminescent Display of the invention in this application shown in drawing 1 and drawing 2 below is explained. Here, the case where a n bit digital drive method performs the full color display of 2n gradation is explained. In addition, since the timing chart is the same as the case where the form of operation shows, drawing 3 is referred to.

[0348] Two or more pixels 104 are arranged by the shape of a matrix at the pixel section 101. The enlarged view of a pixel 104 is shown in drawing 2 (A). In drawing 2 (A), 105 is TFT for switching. The gate electrode of TFT105 for switching is connected to the gate signal line 106 which inputs a gate signal. The source field and drain field of TFT105 for switching are connected to the capacitor 113 which the gate electrode and each pixel of TFT108 for EL drive have [another side] in the source signal line 107 into which one side inputs a digital data signal, respectively.

[0349] Moreover, as for the source field and drain field of TFT108 for EL drive, one side is connected to the current supply line 111, and another side is connected to EL element 110. The current supply line 111 is connected to the capacitor 113. When TFT105 for switching is in the state (OFF state) where it does not choose, the capacitor 113 is formed in order to hold the gate voltage of TFT108 for EL drive.

[0350] EL element 110 consists of an EL layer prepared between an anode plate, cathode, and an anode plate and cathode. When the anode plate has connected with the source field of TFT110 for EL drive, or a drain field, it puts in another way and an anode plate is a pixel electrode, the cathode which is a counterelectrode is maintained at fixed potential. Conversely, when cathode has connected with the source field of TFT110 for EL drive, or a drain field, it puts in another way and cathode is a pixel electrode, the anode plate which is a counterelectrode is maintained at fixed potential.

[0351] The current supply line 111 is maintained at power supply potential.

[0352] In addition, you may prepare a resistor between the drain field of TFT108 for EL drive or a source field, and EL element 110. By preparing a resistor, the amount of current supplied to an EL element from TFT for EL drive is controlled, and it becomes possible to prevent the influence of the variation in the property of TFT for EL drive. If a resistor is an element which shows resistance larger enough than the on resistance of TFT108 for EL drive, since it is good, there will be no limitation in structure etc. In addition, an on resistance is the value which broke the drain voltage of TFT by the drain current which is flowing then, when TFT is an ON state. What is necessary is just to choose from the range of 1kohm-50M omega (preferably 10 k ohm - 10 M omega, still more preferably 50 k ohm - 1 M omega) as resistance of a resistor. When a semiconductor layer with resistance high as a resistor is used, formation is easy and desirable.

[0353] The structure of the pixel section of the ElectroLuminescent Display of the invention in this application is shown in drawing 2 (B). The gate signal line (G1-Gn) is connected to the gate electrode of TFT for switching which each pixel has. One side is connected to a source signal line (S1-Sn), and, as for the source field and drain field of TFT for switching which each pixel has, another side is connected to the gate electrode and capacitor of TFT for EL drive. Moreover, as for the source field and drain field of TFT for EL drive, one side is connected to the current supply line (V1-Vn) at the EL element which each pixel has [another side]. The capacitor by which each pixel has a current supply line (V1-Vn) is connected.

[0354] The timing chart in the ElectroLuminescent Display shown in drawing 2 (A) is shown in drawing 3 . First, an one-frame period (F) is divided during [n] the subframe (SF1-SFn). In addition, all the pixels of the pixel section call the period which displays one picture one-frame period. In the ElectroLuminescent Display of the invention in this application, 120 or more frame periods are prepared in 1 second, and 60 or more pictures are displayed in 1 second as a result.

[0355] When the number of the pictures displayed in 1 second becomes less than 120, a flicker of pictures, such as a flicker, begins to be visually conspicuous.

[0356] In addition, the period which divided the one-frame period into plurality further is called subframe period. The number of partitions of an one-frame period must also increase as the number of gradation increases, and you have to drive a drive circuit on high frequency.

[0357] One subframe period is divided into an address period (Ta) and a sustain period (Ts). An address period is time taken to input data into all pixels during the 1 subframe, and the sustain period (it is also called a lighting period) shows the period which

displays.

[0358] All the length of the address period (Ta1-Tan) which it has, respectively has n the same subframe periods (SF1-SFn). SF1-SFn set to Ts1-Tsn the sustain period (Ts) which it has, respectively, respectively.

[0359] The length of a sustain period is [-- It sets up so that it may become :2-(n-2):2- (n-1).] Ts1:Ts2:Ts3. : -- It is :Ts(n-1):Tsn=20:2-1:2-2. : However, you may carry out sequence of making SF1-SFn appearing, what. A desired gradation display can be performed among 2n gradation in the combination of this sustain period.

[0360] In the address period, the current supply line (V1-Vn) is first maintained at the power supply potential of the same height as regular potential. In this specification, it is called the power supply potential of OFF of the power supply potential in the address period of a digital drive. In addition, the height of the power supply potential of OFF is the range in which an EL element does not emit light, and if it is the same as the height of regular potential, it is good. In addition, it is called EL driver voltage of OFF of EL driver voltage at this time. Although it is ideally desirable that it is 0V as for EL driver voltage of OFF, what is necessary is just the size which is the grade to which an EL element does not emit light.

[0361] And a gate signal is inputted into the gate signal line G1, and all TFT for switching by which the gate electrode is connected to the gate signal line G1 will be in the state of ON.

[0362] In the state of ON of TFT for switching by which the gate electrode is connected to the gate signal line G1, a digital data signal is inputted into a source signal line (S1-Sn) in order. The digital data signal has the information on "0" or "1", and means the signal with which the digital data signal of "0" and "1" has the voltage of either Hi or Lo, respectively. And the digital data signal inputted into the source signal line (S1-Sn) is inputted into the gate electrode of TFT for EL drive through TFT for switching of the state of ON (ON). Moreover, a digital data signal is inputted also into a capacitor and it is held.

[0363] Next, a gate signal is inputted into the gate signal line G2, and all TFT for switching by which the gate electrode is connected to the gate signal line G2 will be in the state of ON. And where TFT for switching by which the gate electrode is connected to the gate signal line G2 is turned ON, a digital data signal is inputted into a source signal line (S1-Sn) in order. The digital data signal inputted into the source signal line (S1-Sn) is inputted into the gate electrode of TFT for EL drive through TFT for switching. Moreover, a digital data signal is inputted also into a capacitor and it is held.

[0364] Operation mentioned above is repeated and a digital data signal is inputted into all pixels. A period until a digital data signal is inputted into all pixels is an address period.

[0365] A sustain period comes at the same time an address period expires. If a sustain period comes, the potential of a current supply line (V1-Vn) will change to the power supply potential of ON from the power supply potential of OFF. In this specification, it is called the power supply potential of ON of the power supply potential in the sustain period of a digital drive. The power supply potential of ON should just have the potential difference between regular potentials in the grade to which an EL element emits light. In addition, it is called EL driver voltage of ON of this potential difference.

[0366] And TFT for switching is turned off and the digital data signal held in the capacitor is inputted into the gate electrode of TFT for EL drive.

[0367] In this example, when the digital data signal has the information on "0", TFT for EL drive will be in an OFF state, and the pixel electrode of an EL element is maintained at the power supply potential of OFF. Consequently, the EL element which the pixel to which the digital data signal which has the information on "0" was impressed has does not emit light.

[0368] On the contrary, when it has the information on "1", TFT for EL drive will be in an ON state, and the pixel electrode of an EL element becomes the power supply potential of ON. Consequently, the EL element which the pixel to which the digital data signal which has the information on "1" was impressed has emits light.

[0369] The period all whose TFT for switching is OFF states is a sustain period.

[0370] The periods which make an EL element emit light (a pixel is made to turn on) are one to Ts1-Tsn of periods. Here, it carries out to having made the pixel of Tsn predetermined during the period turn on.

[0371] Next, it enters during the address again, and if a data signal is inputted into all pixels, it will enter during the sustain. At this time, the period of either Ts1-Ts (n-1) turns into a sustain period. Here, it carries out to having made the pixel of Ts (n-1) predetermined during the period turn on.

[0372] The operation same about the n-2 remaining subframes is repeated hereafter, and they are Ts (n-2) and Ts (n-3) one by one. -- Ts1 and a sustain period are set up and it carries out to having made the pixel predetermined by each subframe turn on.

[0373] When n subframe periods appear, it means finishing an one-frame period. At this time, the gradation of the pixel is decided by integrating the length of the sustain period immediately after the sustain period which the pixel had turned on, and the address period when the digital data signal which in other words has the information

on "1" was impressed to the pixel. For example, when brightness when a pixel emits light in all sustain periods was made into 100% at the time of n= 8 and a pixel emits light in Ts1 and Ts2, 75% of brightness can be expressed, and when Ts3, and Ts5 and Ts8 are chosen, 16% of brightness can be expressed.

[0374] An end of an one-frame period changes the height of the power supply potential of ON so that the polarity of EL driver voltage of the ON which is the difference of regular potential and the power supply potential of ON may become reverse in the next frame period. and a previous frame period -- the same -- operation mentioned above is performed However, since EL driver voltage of the ON in this frame period has the reverse polarity of EL driver voltage of the ON in a previous frame period, no EL elements emit light. In this specification, the frame period when an EL element displays a picture is called display frame period. Moreover, the frame period which does not display a picture, without no EL elements emitting light conversely is called non-display frame period.

[0375] After a non-display frame period expires, display frame period another next comes and EL driver voltage of ON changes to the voltage which has the reverse polarity of EL driver voltage of the ON in a non-display frame period.

[0376] Thus, a picture is displayed by repeating a display frame period and a non-display frame period by turns. The invention in this application is having the above-mentioned composition, and requires reverse polar EL driver voltage for EL layer which an EL element has for every fixed period. Therefore, degradation of the current-voltage characteristic of an EL element is improved and it becomes possible to lengthen the life of an EL element compared with the conventional drive method.

[0377] Moreover, in an alternating current drive, as mentioned above, when displaying a picture for every one-frame period, a flicker will arise as a flicker to an observer's eyes.

[0378] Therefore, at the invention in this application, the alternating current drive of the ElectroLuminescent Display is carried out on the frequency of the double not less of the frequency which a flicker does not produce to an observer's eyes in a direct-current drive. That is, 120 or more frame periods are prepared in 1 second, and 60 or more pictures are displayed in 1 second as a result. The above-mentioned composition protects the flicker by alternating current drive.

[0379] It combines with examples 2-9 freely, and composition shown in this example can be carried out.

[0380] (Example 11) By this example, when performing a time-sharing gradation display by the alternating current drive of a digital method, example with an another

example 1 which changes EL driver voltage of ON for every subframe period at reverse polarity is explained. Here, the case where a n bit digital drive method performs the full color time-sharing gradation display of 2n gradation is explained. In addition, since the timing chart is the same as the case where an example 1 shows, drawing 5 is referred to.

[0381] The structure of the pixel section of the ElectroLuminescent Display in this example is the same as the structure shown in drawing 2 (B), and the gate signal line (G1-Gn) is connected to the gate electrode of TFT for switching which each pixel has. One side is connected to a source signal line (S1-Sn), and, as for the source field and drain field of TFT for switching which each pixel has, another side is connected to the gate electrode and capacitor of TFT for EL drive. Moreover, as for the source field and drain field of TFT for EL drive, one side is connected to the current supply line (V1-Vn) at the EL element which each pixel has [another side]. The capacitor by which each pixel has a current supply line (V1-Vn) is connected.

[0382] The timing chart of the drive method of this example is shown in drawing 5 . First, an one-frame period is divided during [n] the subframe (SF1-SFn). In addition, all the pixels of the pixel section call the period which displays one picture one-frame period.

[0383] One subframe period is divided into an address period (Ta) and a sustain period (Ts). An address period is time taken to input data into all pixels during the 1 subframe, and the sustain period (it is also called a lighting period) shows the period which makes an EL element emit light.

[0384] All the length of the address period (Ta1-Tan) which it has, respectively has n the same subframe periods (SF1-SFn). SF1-SFn set to Ts1-Tsn the sustain period (Ts) which it has, respectively, respectively.

[0385] The length of a sustain period is [-- It sets up so that it may become :2-(n-2):2- (n-1).] Ts1:Ts2:Ts3. : -- It is :Ts(n-1):Tsn=20:2-1:2-2. : However, you may carry out sequence of making SF1-SFn appearing, what. A desired gradation display can be performed among 2n gradation in the combination of this sustain period.

[0386] First, a current supply line (V1-Vn) is maintained at the power supply potential of OFF. And a gate signal is inputted into the gate signal line G1, and all TFT for switching by which the gate electrode is connected to the gate signal line G1 will be in the state of ON.

[0387] And in the state of ON of TFT for switching by which the gate electrode is connected to the gate signal line G1, a digital data signal is inputted into a source signal line (S1-Sn) in order. And the digital data signal inputted into the source signal

line (S1-Sn) is inputted into the gate electrode of TFT for EL drive through TFT for switching of the state of ON (ON). Moreover, a digital data signal is inputted also into a capacitor and it is held.

[0388] Operation mentioned above is repeated and a digital data signal is inputted into all pixels. A period until a digital data signal is inputted into all pixels is an address period.

[0389] A sustain period comes at the same time an address period expires. If a sustain period comes, the potential of a current supply line (V1-Vn) will change to the power supply potential of ON from the power supply potential of OFF. And TFT for switching is turned off and the digital data signal held in the capacitor is inputted into the gate electrode of TFT for EL drive.

[0390] In this example, the polarity of EL driver voltage of the ON which is the difference of the power supply potential of ON and a stationary potential becomes reverse for every subframe period by changing the height of power supply potential. Therefore, by making reverse polarity of EL driver voltage of ON in every subframe period, an ElectroLuminescent Display repeats a display and un-displaying. The subframe period which displays is called display subframe period, and the subframe period which does not display is called non-display subframe period.

[0391] For example, in the 1st frame period, supposing the 1st subframe period is a display period, the 2nd subframe period will be a non-display period, and the 3rd frame period will turn into a display period again. And if all subframe periods appear and the 1st frame period expires, the 2nd frame period will come. In the 1st subframe period in the 2nd frame period, since EL driver voltage which has polarity contrary to EL driver voltage applied to the EL element in the 1st subframe period within the 1st frame period is applied to EL layer of an EL element, it serves as a non-display period. And next, the 2nd subframe period turns into a display period, and turns into a display period and a non-display period by turns for every subframe period.

[0392] In addition, in this specification, the polarity of EL driver voltage calls the period when displaying display period, when a display and un-displaying change by the bird clapper conversely. Moreover, the period when not displaying conversely is called non-display period. Therefore, in this specification, a display frame period and a display subframe period are named generically, and it is called a display period. Moreover, a non-display frame period and a non-display subframe period are conversely named generically, and it is called a non-display period.

[0393] When the digital data signal has the information on "0" in this example, TFT for EL drive will be in an OFF state, and the pixel electrode of an EL element is

maintained at the power supply potential of OFF. Consequently, the EL element which the pixel to which the digital data signal which has the information on "0" was added has does not emit light.

[0394] On the contrary, when it has the information on "1", TFT for EL drive will be in an ON state, and the pixel electrode of an EL element becomes the power supply potential of ON. Consequently, the EL element which the pixel as which the digital data signal which has the information on "1" was inputted has emits light.

[0395] The period all whose TFT for switching is OFF states is a sustain period.

[0396] The periods which make an EL element emit light (a pixel is made to turn on) are one to Ts1-Tsn of periods. Here, it carries out to having made the pixel of Tsn predetermined during the period turn on.

[0397] Next, it enters during the address again, and if a data signal is inputted into all pixels, it will enter during the sustain. At this time, the period of either Ts1-Ts (n-1) turns into a sustain period. Here, it carries out to having made the pixel of Ts (n-1) predetermined during the period turn on.

[0398] The operation same about the n-2 remaining subframes is repeated hereafter, and they are Ts (n-2) and Ts (n-3) one by one. -- Ts1 and a sustain period are set up and it carries out to having made the pixel predetermined by each subframe turn on.

[0399] Thus, in the time-sharing gradation display of an alternating current drive, when applying to an EL element EL driver voltage which has reverse polarity for every subframe, one gradation display is performed in two frame periods. In two adjacent frame periods, the gradation of the pixel is decided by integrating the length of the sustain period immediately after the sustain period which the pixel had turned on, and the address period when the digital data signal which in other words has the information on "1" was inputted into the pixel. For example, when brightness when a pixel emits light in all sustain periods was made into 100% at the time of n= 8 and a pixel emits light in Ts1 and Ts2, 75% of brightness can be expressed, and when Ts3, and Ts5 and Ts8 are chosen, 16% of brightness can be expressed.

[0400] The invention in this application is having the above-mentioned composition, and requires reverse polar EL driver voltage for EL layer which an EL element has for every subframe period. Therefore, degradation of the current-voltage characteristic of an EL element is improved and it becomes possible to lengthen the life of an EL element compared with the conventional drive method.

[0401] In this example, the effect that a flicker cannot happen easily compared with the ElectroLuminescent Display of the digital method which carries out an alternating current drive for every frame period shown with the gestalt of operation is acquired.

[0402] It combines with examples 2-9 freely, and composition shown in this example can be carried out.

[0403] (Example 12) Since the ElectroLuminescent Display (EL module) formed by carrying out the invention in this application is a spontaneous light type, it is excellent in the visibility in a bright place compared with the liquid crystal display. Therefore, the invention in this application can be carried out to the ElectroLuminescent Display (the display display incorporating EL module is pointed out) of a direct viewing type. As an ElectroLuminescent Display, a personal computer monitor, the monitor for TV broadcast reception, an advertising display monitor, etc. are mentioned.

[0404] Moreover, the invention in this application can be carried out to all the electronic equipment that includes a display display as parts also including an above-mentioned ElectroLuminescent Display.

[0405] As such electronic equipment, the picture reproducer (equipment equipped with the display which specifically reproduces record media, such as a compact disk (CD), a laser disc (registered trademark) (LD), or a digital videodisc (DVD), and can display the picture) equipped with EL display, a video camera, a digital camera, head installation type displays (head mount display etc.), car navigation, a personal computer, Personal Digital Assistants (a mobile computer, a cellular phone, or digital book), and the record medium etc. is mentioned. The example of these electronic equipment is shown in drawing 14 .

[0406] Drawing 14 (A) is a personal computer and contains a main part 2001, a case 2002, ElectroLuminescent Display 2003, and keyboard 2004 grade. ElectroLuminescent Display 2003 of the invention in this application can be used for the display of a personal computer.

[0407] Drawing 14 (B) is a video camera and contains a main part 2101, ElectroLuminescent Display 2102, the voice input section 2103, the operation switch 2104, a dc-battery 2105, and television section 2106 grade. ElectroLuminescent Display 2102 of the invention in this application can be used for the display of a video camera.

[0408] Drawing 14 (C) is some head installation type EL display (right one side), and contains a main part 2301, a signal cable 2302, the head fixed band 2303, the display monitor 2304, optical system 2305, and ElectroLuminescent Display 2306 grade. ElectroLuminescent Display 2306 of the invention in this application can be used for the display of EL display.

[0409] Drawing 14 (D) is the picture reproducer (specifically DVD regenerative apparatus) equipped with the record medium, and contains a main part 2401, record

media (CD, LD, or DVD) 2402, the operation switch 2403, ElectroLuminescent Display (a) 2404, and ElectroLuminescent Display (b)2405 grade. Although an ElectroLuminescent Display (a) mainly displays image information and an ElectroLuminescent Display (b) mainly displays alphabetic information, these ElectroLuminescent Displays (a) of the invention in this application and (b) can be used for the display of the picture reproducer equipped with the record medium. In addition, the invention in this application can be used for CD regenerative apparatus, a game machine machine, etc. as a picture reproducer equipped with the record medium.

[0410] Drawing 14 (E) is a carried type (mobile) computer, and contains a main part 2501, the camera section 2502, the television section 2503, the operation switch 2504, and ElectroLuminescent Display 2505 grade. ElectroLuminescent Display 2505 of the invention in this application can be used for the display of a carried type (mobile) computer.

[0411] Moreover, if the luminescence brightness of EL material will become high in the future, it will also become possible to use for the projector of a front type or a rear mold.

[0412] As mentioned above, the scope of the invention in this application is very wide, and applying to the electronic equipment of all fields is possible. Moreover, even if the electronic equipment of this example uses the composition which consists of combination like an example 1 - 11 throats, it is realizable.

[0413]

[Effect of the Invention]

[0414] By the above-mentioned composition, reverse polar EL driver voltage is built over an EL element for every fixed period. Therefore, degradation of the current-voltage characteristic of an EL element is improved and it becomes possible to lengthen the life of an EL element compared with the conventional drive method.

[0415] Moreover, in an alternating current drive, as mentioned above, when displaying a picture for every one-frame period, a flicker will arise as a flicker to an observer's eyes.

[0416] Therefore, in the invention in this application, it is desirable to carry out the alternating current drive of the ElectroLuminescent Display on the frequency of the double not less of the frequency which a flicker does not produce to an observer's eyes in a direct-current drive. That is, it is desirable to express a picture as the frequency of 120Hz or more. The above-mentioned composition protects the flicker by alternating current drive.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing showing the composition of the ElectroLuminescent Display of the invention in this application.
[Drawing 2] The circuit diagram of the pixel section of the invention in this application.
[Drawing 3] The timing chart of an alternating current drive of the digital method of the invention in this application.
[Drawing 4] The timing chart of an alternating current drive of the analog method of the invention in this application.
[Drawing 5] The timing chart of an alternating current drive of the digital method of the invention in this application.
[Drawing 6] The circuit diagram and plan of the pixel section of the invention in this application. [of an ElectroLuminescent Display]
[Drawing 7] Drawing showing the cross-section structure of the ElectroLuminescent Display of the invention in this application.
[Drawing 8] Drawing showing the production process of an ElectroLuminescent Display.
[Drawing 9] Drawing showing the production process of an ElectroLuminescent Display.
[Drawing 10] Drawing showing the production process of an ElectroLuminescent Display.
[Drawing 11] Drawing showing the production process of an ElectroLuminescent

Display.

[Drawing 12] Drawing showing the appearance of EL module.

[Drawing 13] Drawing showing the appearance of EL module.

[Drawing 14] Drawing showing the example of electronic equipment.

[Drawing 15] The circuit diagram of the pixel section of the conventional ElectroLuminescent Display.

[Drawing 16] The timing chart of an alternating current drive of the conventional digital method.

[Drawing 17] The circuit diagram of the pixel section of the ElectroLuminescent Display of the invention in this application.

[Drawing 18] The circuit diagram of the pixel section of the ElectroLuminescent Display of the invention in this application.

[Drawing 19] The circuit diagram of the pixel section of the ElectroLuminescent Display of the invention in this application.

[Drawing 20] The circuit diagram of the pixel section of the ElectroLuminescent Display of the invention in this application.

[Drawing 21] Drawing showing the cross-section structure of the ElectroLuminescent Display of the invention in this application.

[Description of Notations]

101 Pixel Section

102 Source Signal Side Drive Circuit

103 Gate Signal Side Drive Circuit

104 Pixel

105 TFT for Switching

106 Gate Signal Line

107 Source Signal Line

108 TFT for EL Drive

110 EL Element

111 Current Supply Line

112 Regular Power Supply

113 Capacitor

114 Time-Sharing Gradation Data Signal Generating Circuit

[Translation done.]

CLAIMS

[Claim(s)]

[Claim 1] Are the display which has two or more pixels containing two or more EL elements, and a gradation display is performed because the aforementioned display controls time for two or more aforementioned EL elements in an one-frame period to emit light. The polarity of EL driver voltage which two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and is the difference of the potential of the 1st electrode of the above and the potential of the 2nd electrode of the above is display conversely characterized by the bird clapper for every one-frame period.

[Claim 2] It is the display which has two or more pixels containing two or more EL elements. the aforementioned display A gradation display is performed by controlling the sum of the length of the subframe period when two or more aforementioned EL elements emitted light among two or more subframe periods contained in an one-frame period. The polarity of EL driver voltage which two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and is the difference of the potential of the 1st electrode of the above and the potential of the 2nd electrode of the above is display conversely characterized by the bird clapper for every aforementioned subframe period.

[Claim 3] Two or more EL elements. Two or more pixels containing two or more TFT for EL drive which controls luminescence of two or more aforementioned EL elements, respectively, and two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. It is the display equipped with the above, and a gradation display is performed because the aforementioned display controls time for two or more aforementioned EL elements in an one-frame period to

emit light, two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and polarity of EL driver voltage which is the difference of the potential of the 1st electrode of the above and the potential of the 2nd electrode of the above is conversely characterized by the bird clapper for every one-frame period.
[Claim 4] Two or more EL elements. Two or more pixels containing two or more TFT for EL drive which controls luminescence of two or more aforementioned EL elements, respectively, and two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. It is the display equipped with the above. the aforementioned display A gradation display is performed by controlling the sum of the length of the subframe period when two or more aforementioned EL elements emitted light among two or more subframe periods contained in an one-frame period. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and polarity of EL driver voltage which is the difference of the potential of the 1st electrode of the above and the potential of the 2nd electrode of the above is conversely characterized by the bird clapper for every aforementioned subframe period.
[Claim 5] Are the display which has two or more pixels containing two or more EL elements, and a gradation display is performed because the aforementioned display controls time for two or more aforementioned EL elements in an one-frame period to emit light. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the polarity of EL driver voltage which is the difference of the potential of the 1st electrode of the above, and the potential of the 2nd electrode of the above Display characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above between the pixels which are reverse for every one-frame period, and adjoin each other among two or more aforementioned pixels.
[Claim 6] It is the display which has two or more pixels containing two or more EL elements. the aforementioned display A gradation display is performed by controlling the sum of the length of the subframe period when two or more aforementioned EL elements emitted light among two or more subframe periods contained in an one-frame period. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the polarity of EL driver voltage which is the difference of the potential of the 1st electrode of the above, and the potential of the 2nd electrode of the above Display characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above between the pixels which are reverse for every aforementioned subframe period, and adjoin each

other among two or more aforementioned pixels.

[Claim 7] Two or more EL elements. Two or more pixels containing two or more TFT for EL drive which controls luminescence of two or more aforementioned EL elements, respectively, and two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. Are the display equipped with the above and a gradation display is performed because the aforementioned display controls time for two or more aforementioned EL elements in an one-frame period to emit light. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the polarity of EL driver voltage which is the difference of the potential of the 1st electrode of the above, and the potential of the 2nd electrode of the above It is reverse for every one-frame period, and is characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above between the pixels which adjoin each other among two or more aforementioned pixels.

[Claim 8] Two or more EL elements. Two or more pixels containing two or more TFT for EL drive which controls luminescence of two or more aforementioned EL elements, respectively, and two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. It is the display equipped with the above. the aforementioned display A gradation display is performed by controlling the sum of the length of the subframe period when two or more aforementioned EL elements emitted light among two or more subframe periods contained in an one-frame period. Two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and the polarity of EL driver voltage which is the difference of the potential of the 1st electrode of the above, and the potential of the 2nd electrode of the above It is reverse for every aforementioned subframe period, and is characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above between the pixels which adjoin each other among two or more aforementioned pixels.

[Claim 9] It is the display characterized by the aforementioned TFT for EL drive and the aforementioned TFT for switching being n channel type TFT or p-channel type TFT in any 1 term of a claim 3, a claim 4, a claim 7, or a claim 8.

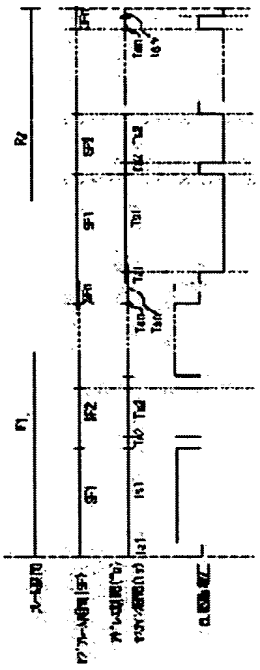
[Claim 10] It is the display characterized by being controlled by the digital data signal by which luminescence of two or more aforementioned EL elements is inputted into TFT for switching in any 1 term of a claim 1 or a claim 9.

[Claim 11] Display characterized by the aforementioned one-frame period being 1/120 or less s in any 1 term of a claim 1 or a claim 10.

[Claim 12] Two or more EL elements. Two or more pixels containing two or more TFT for EL drive which controls luminescence of two or more aforementioned EL elements, respectively, and two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. It is the display equipped with the above, and a gradation display is performed in the aforementioned display inputting the video signal of an analog into the source field of TFT for switching, two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively, and polarity of EL driver voltage which is the difference of the potential of the 1st electrode of the above and the potential of the 2nd electrode of the above is conversely characterized by the bird clapper for every one-frame period.
[Claim 13] Two or more EL elements. Two or more pixels containing two or more TFT for EL drive which controls luminescence of two or more aforementioned EL elements, respectively, and two or more TFT for switching which controls the drive of two or more aforementioned TFT for EL drive, respectively. It is the display equipped with the above. the aforementioned display A gradation display is performed in inputting the video signal of an analog into the source field of TFT for switching, and two or more aforementioned EL elements have the 1st electrode and 2nd electrode, respectively. The potential of the 1st electrode of the above, The polarity of EL driver voltage which is the difference of the potential of the 2nd electrode of the above is reverse for every one-frame period, is the pixels which adjoin each other among two or more aforementioned pixels, and is characterized by sharing the current supply line which supplies the voltage concerning the 2nd electrode of the above.
[Claim 14] It is the display characterized by the aforementioned TFT for EL drive and the aforementioned TFT for switching being n channel type TFT or p-channel type TFT in a claim 12 or a claim 13.
[Claim 15] Display characterized by the aforementioned one-frame period being 1/120 or less s in any 1 term of a claim 12 or a claim 14.
[Claim 16] EL layer which two or more aforementioned EL elements have in any 1 term of a claim 12 or a claim 15 is display characterized by being a low-molecular system organic substance or a polymer system organic substance.
[Claim 17] It is the display with which the aforementioned low-molecular system organic substance is characterized by the bird clapper in a claim 16 from Alq3 (tris-8-KINORI light-aluminum) or TPD (triphenylamine derivative).
[Claim 18] It is the display with which the aforementioned polymer system organic substance is characterized by the bird clapper from PPV (polyphenylene vinylene), PVK (polyvinyl carbazole), or a polycarbonate in a claim 16.

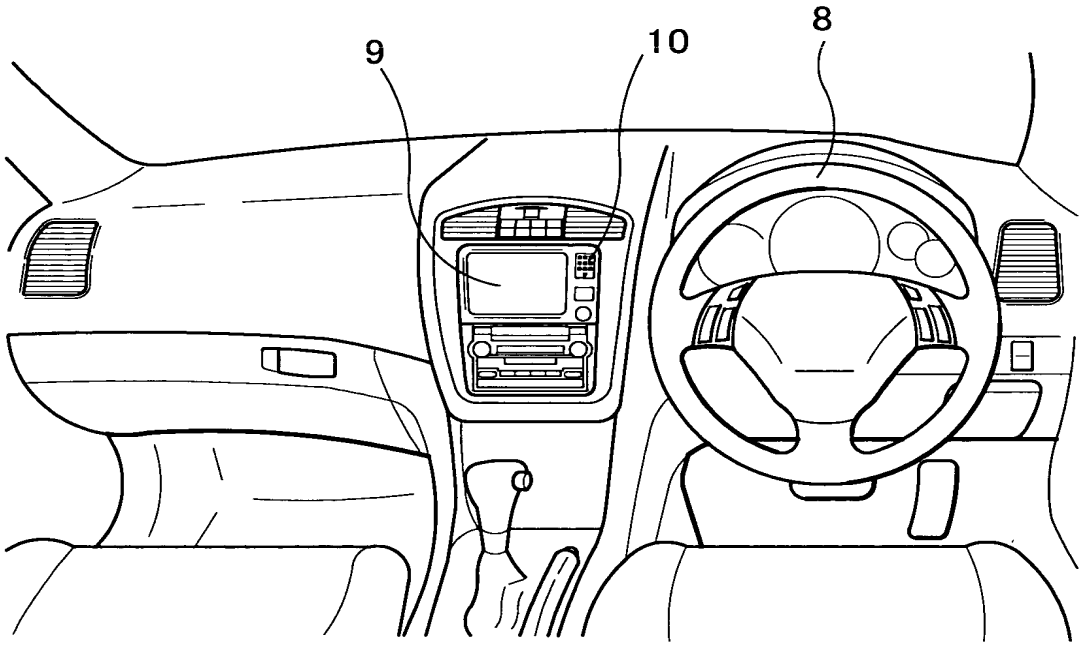
[Claim 19] The computer characterized by using the aforementioned display according to claim 1 to 18.
[Claim 20] The video camera characterized by using the aforementioned display according to claim 1 to 18.
[Claim 21] The DVD player characterized by using the aforementioned display according to claim 1 to 18.

[Translation done.]

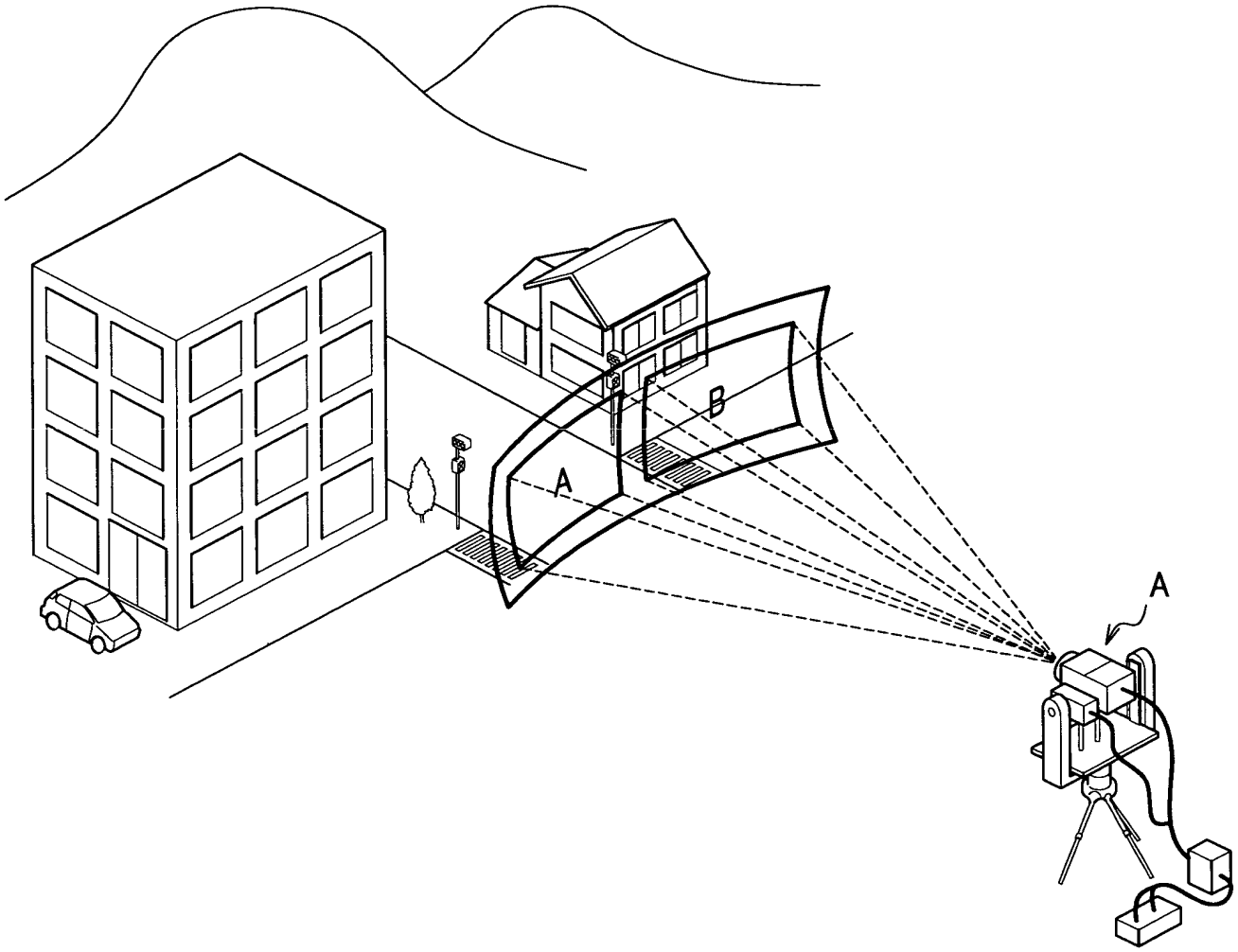


(57)Abstract:
PROBLEM TO BE SOLVED: To provide a display device that service life of EL elements can be extended.
SOLUTION: The display device has plural pixels each of which includes plural EL elements. The electrooptical device conducts gradation display by controlling the light emitting time of the plural EL elements for one frame period. Each of the plural EL elements has first and second electrodes. The first electrode is kept at a constant common potential. The potential of the second electrode is held to a potential having a reverse polarity based on the common potential for every frame period.

【図４】



【図5】

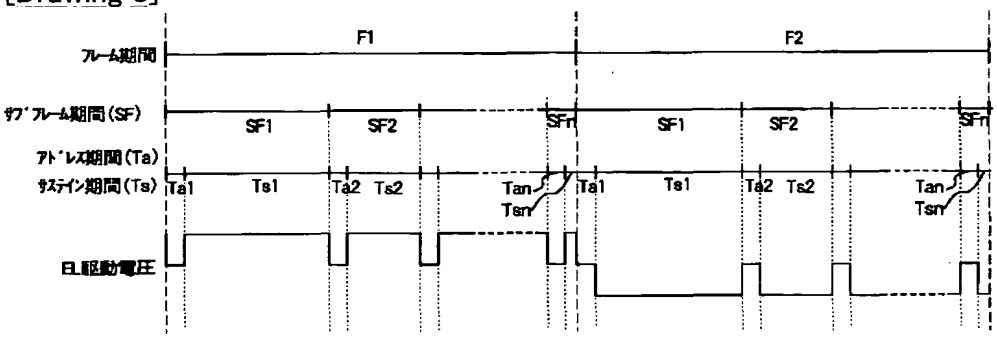


* NOTICES *

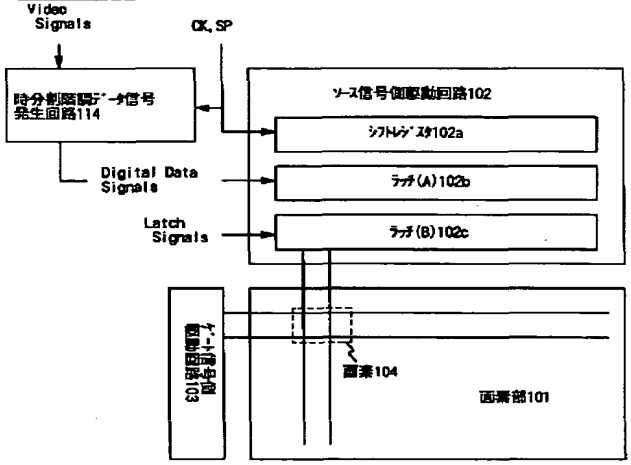
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 3]

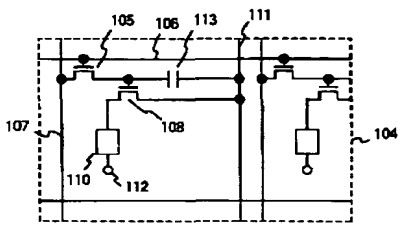


[Drawing 1]



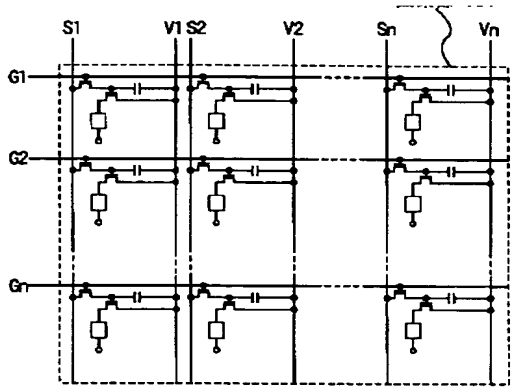
[Drawing 2]

(A)

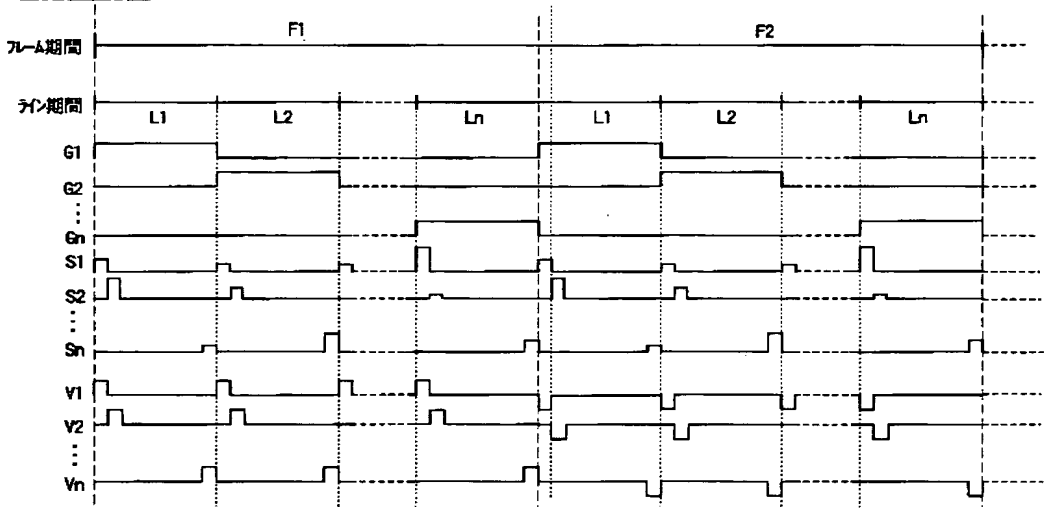


(B)

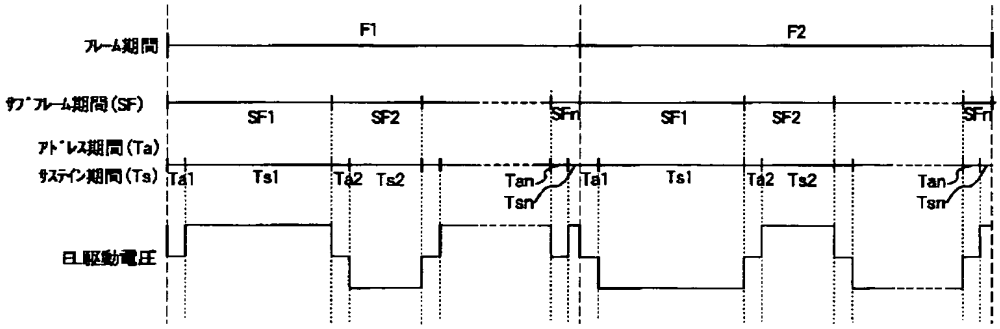
画素部 104



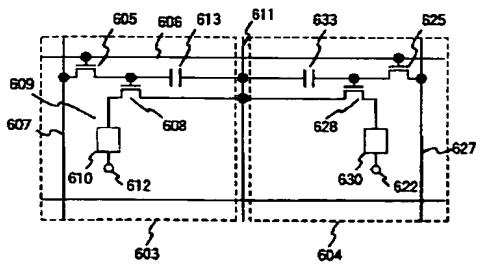
[Drawing 4]



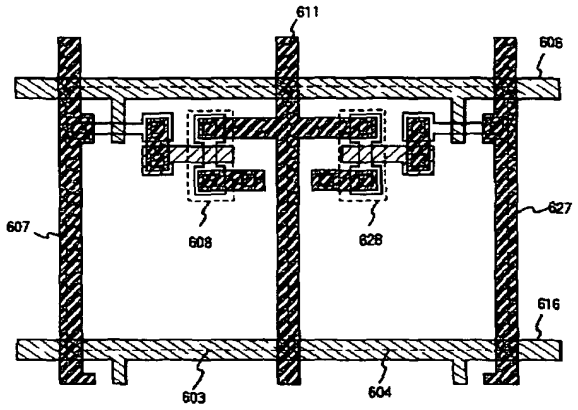
[Drawing 5]



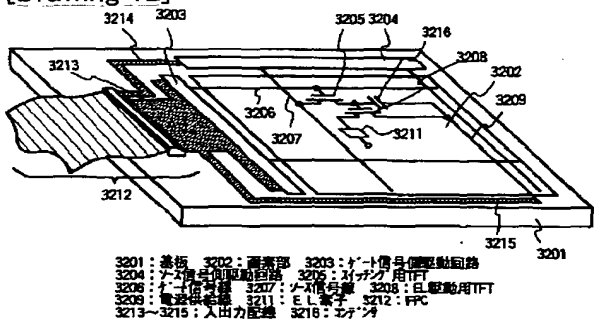
[Drawing 6]
(A)



(B)

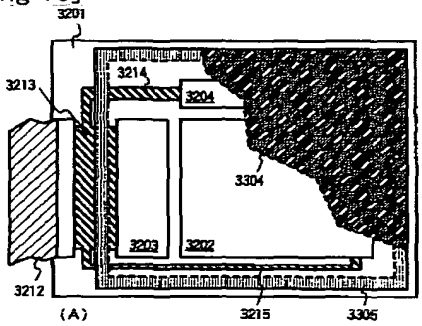


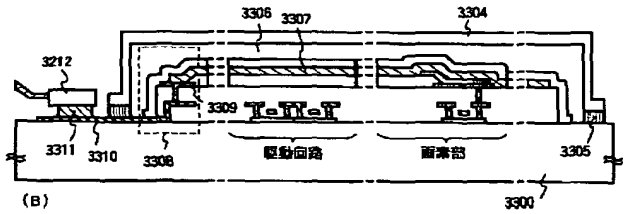
[Drawing 12]



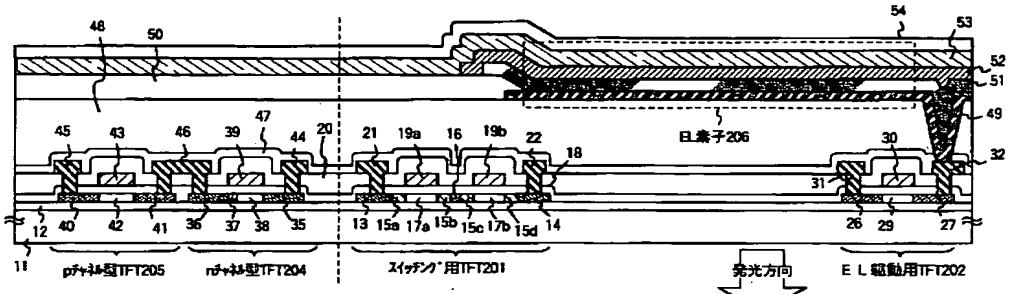
3201：基板 3202：画素部 3203：ゲート信号側駆動回路
3204：ソース信号側駆動回路 3205：スイッチング用TFT
3206：ゲート信号線 3207：ソース信号線 3208：EL駆動用TFT
3209：電流供給線 3211：EL素子 3212：FPC
3213～3215：入出力配線 3216：エンディング

[Drawing 13]



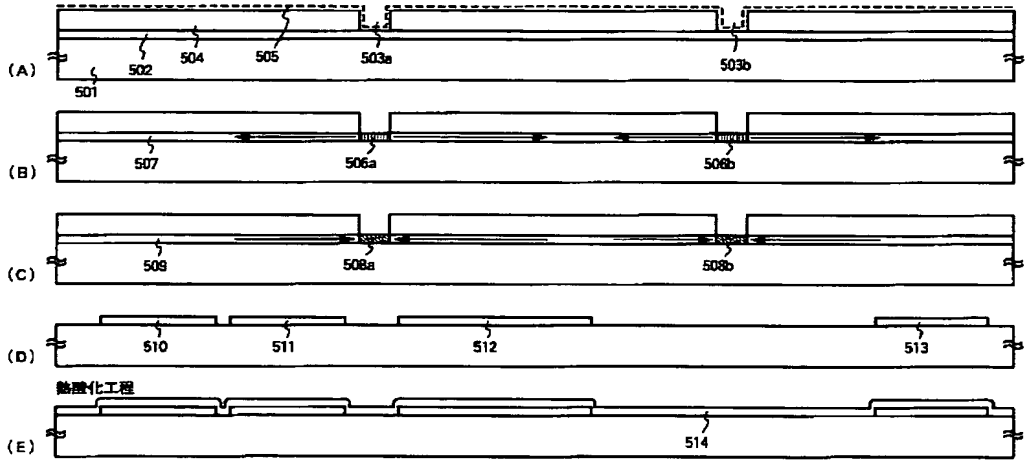


[Drawing 7]



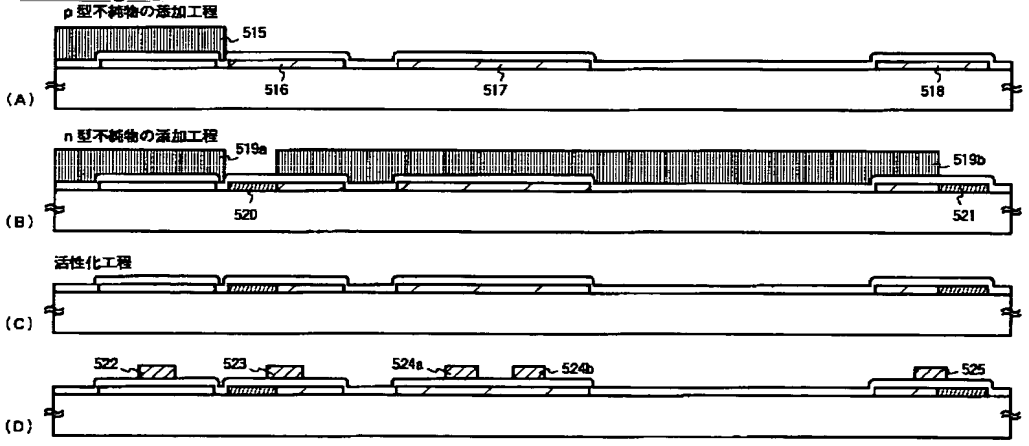
11:基板 12:下地膜 13:ソース領域 14:ドレイン領域 15a～15d:LDD領域 16:分離領域 17a,17b:チャネル形成領域
18:ゲート絶縁膜 19a,19b:ゲート電極 20:第1層間絶縁膜 21:ソース配線 22:ドレイン配線 26:ソース領域 27:ドレイン領域
28:LDD領域 29:チャネル形成領域 30:ゲート電極 31:ソース配線 32:ドレイン配線 35:ソース領域
36:ドレイン領域 37:LDD領域 38:チャネル形成領域 39:ゲート電極 40:ソース領域 41:ドレイン領域 42:チャネル形成領域
43:ゲート電極 44,45:ソース配線 46:ドレイン配線 47:第1パッシベーション膜 48:第2層間絶縁膜 49:画素電極（陽極）
50:第3層間絶縁膜 51:EL層 52:対向電極（陰極） 53:保護電極 54:第2パッシベーション膜

[Drawing 8]



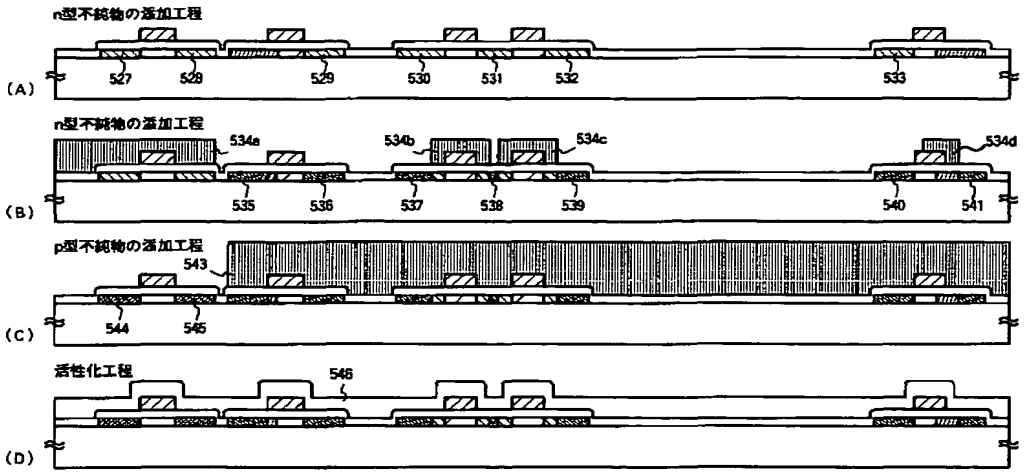
501:石英基板 502:アモルファスシリコン膜 503a,503b:開口部 504:保護膜 505:Ni含有層
506a,506b:Ni添加領域 507:ポリシリコン膜 508a,508b:リン添加領域 509:ポリシリコン膜
510～513:活性層 514:ゲート絶縁膜

[Drawing 9]



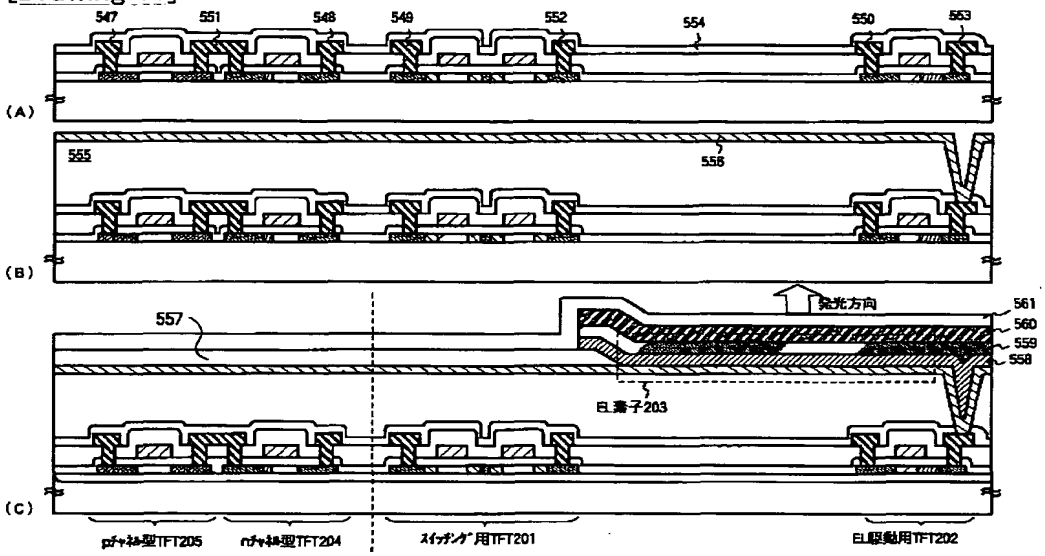
515,519a,519b:レジストマスク 516～518:p型不純物領域 520,521:n型不純物領域
522～525:ゲート電極

[Drawing 10]



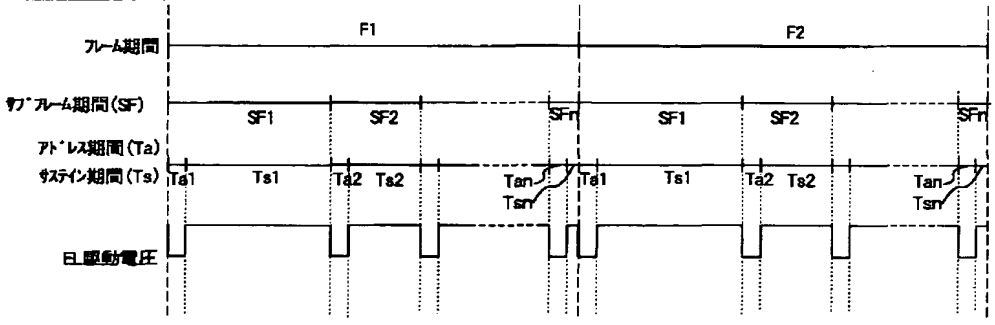
527～533:n型不純物領域　534a～534c, 543:ﾚｼﾞｽﾄﾏｽｸ　535～541:n型不純物領域　544, 545:p型不純物領域
546:第1層間絶縁膜

[Drawing 11]

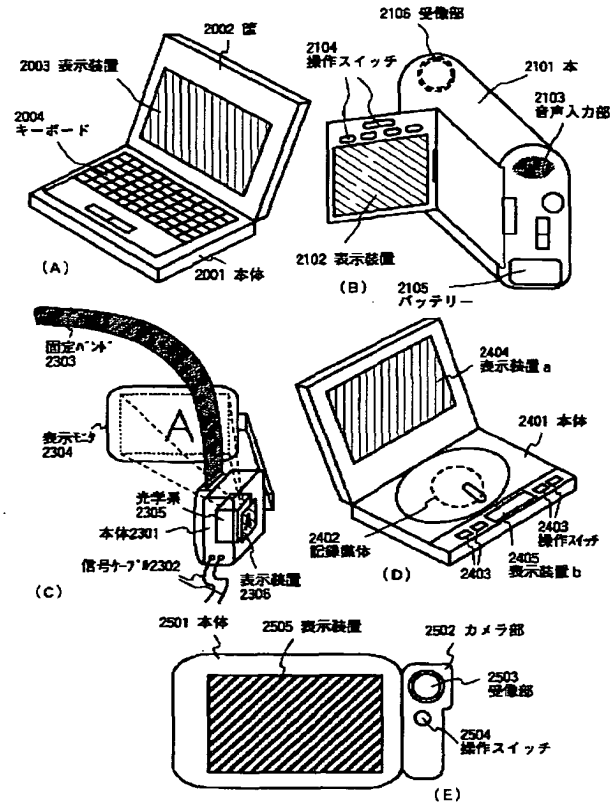


547～550:ソース配線　551～553:ドレイン配線　554:第1パッシベーション膜　555:第2層間絶縁膜　556:保護電極（Al電極）
557:第3層間絶縁膜　558:対向電極（陰極）　559:EL層　560:画素電極（陽極）　561:第2パッシベーション膜

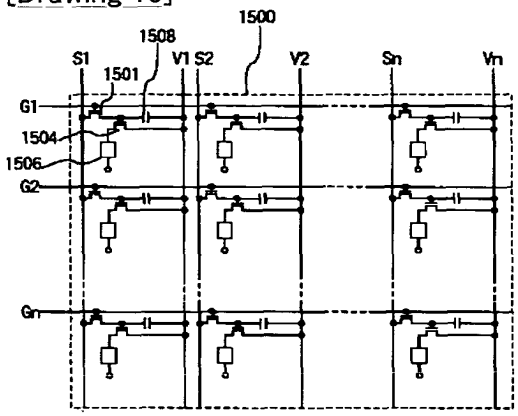
[Drawing 16]



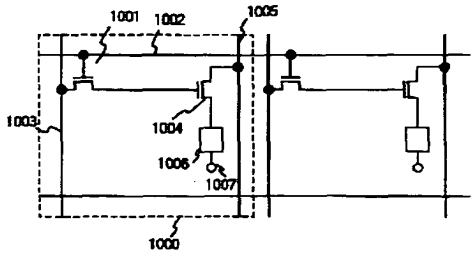
[Drawing 14]



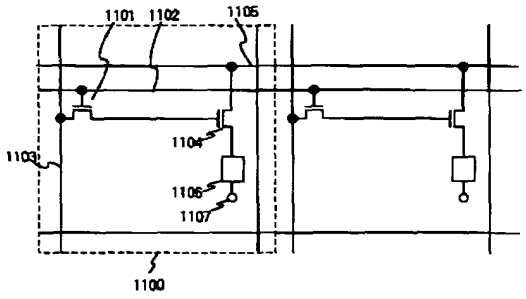
[Drawing 15]



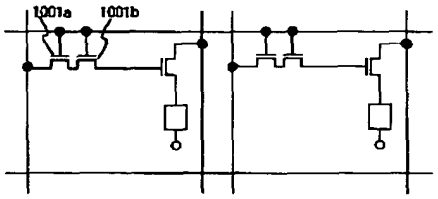
[Drawing 17]
(A)



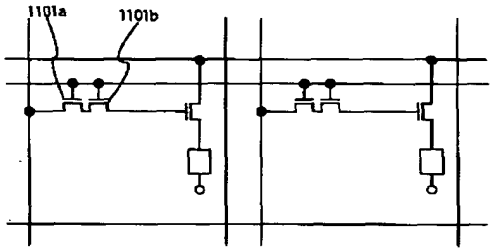
(B)



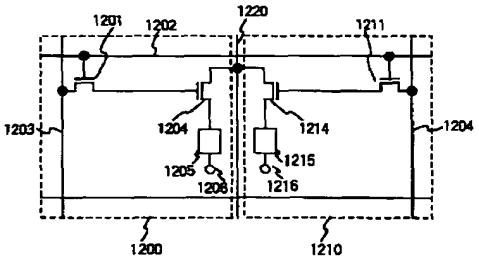
[Drawing 18]
(A)



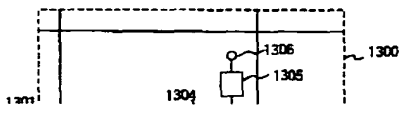
(B)

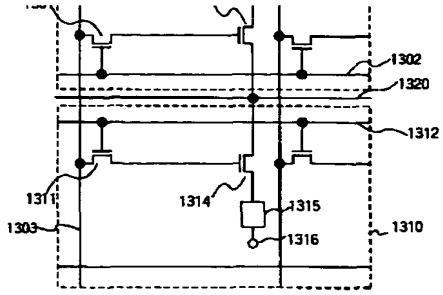


[Drawing 19]
(A)

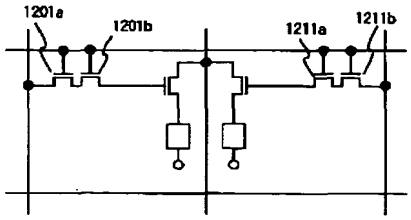


(B)

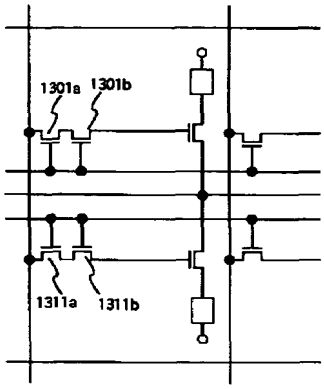




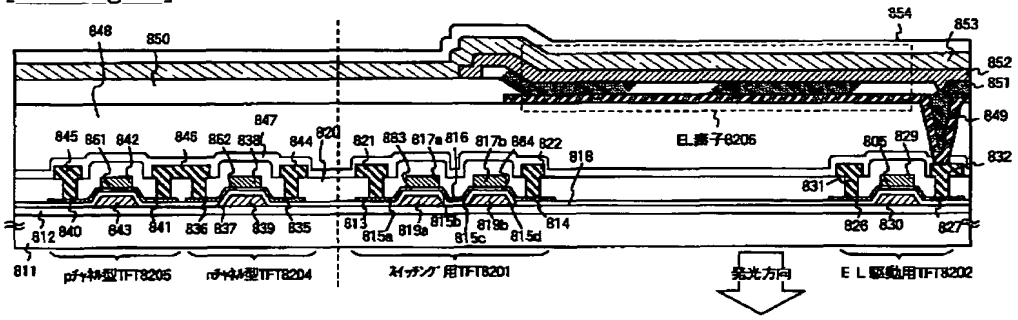
[Drawing 20]
(A)



(B)



[Drawing 21]



811:基板 812:下地膜 813:ソース領域 814:ドレイン領域 815a～815d:LDD領域 816:分離領域 817a,17b:チャネル形成領域
818:ゲート絶縁膜 819a,819b:ゲート電極 820:第1層間絶縁膜 821:ソース配線 822:ドレイン配線 826:ソース領域 827:ドレイン領域
828:LDD領域 829:チャネル形成領域 830:ゲート電極 831:ソース配線 832:ドレイン配線 835:ソース領域
836:ドレイン領域 837:LDD領域 838:チャネル形成領域 839:ゲート電極 840:ソース領域 841:ドレイン領域 842:チャネル形成領域
843:ゲート電極 844,845:ソース配線 846:ドレイン配線 847:第1パッシベーション膜 848:第2層間絶縁膜 849:画素電極（陽極）
850:第3層間絶縁膜 851:EL層 852:対向電極（陰極） 853:保護電極 854:第2パッシベーション膜

[Translation done.]